Electrical Review

WITH WHICH IS CONSOLIDATED WESTERN ELECTRICIAN AND ELECTROCRAFT.

Vol. 73.—No. 24. CHICAGO, SATURDAY, DECEMBER 14, 1918. Page 917.

Night View in Machine Shop of National Lamp Works of General Electric Co.—Mazda Lamps With Special Glare-Eliminating Reflectors Provide a Very Satisfactory General Illumination That No Longer Calls for Use of Local Lamps.

Improved Lighting of Electrical Manufacturing Plants

Development of Electrical Manufacturing Industry—Diversified Products and Operations—Working and Lighting Conditions—Advantages of Improved Lighting—Co-operative Obligation to Modernize the Lighting

By F. H. BERNHARD

This is the last of a series of twelve articles on improvement in lighting in as many different industries. These articles emphasize the desirability of improving industrial lighting to meet present abnormal conditions and those that may come in the near future. The advantages of better lighting are presented in a non-technical way so that they may readily be brought to the attention of factory owners, managers and superintendents, many of whom still have only an imperfect realization of the relation of good lighting to their industries.

Progress in electrical developments has been so extensive and so rapid that this is quite commonly known as the age of electricity. Practically all this progress resulting in the growth of a distinct electrical industry has been achieved within about 40 years. Forty years ago the telegraph was the only application of electricity that had come into considerable use; the dynamo and arc lamp were being introduced and the telephone was in its infancy; the incandescent lamp, the motor, the use of electricity for power, heating and electrolysis, the central generation, transmission and distribution of electrical energy, long-distance telephone and radio communication, and other important present-day electrical developments were either not yet conceived or had seen the experimental or laboratory stage only.

Development and Scope of Electrical Manufacturing.

From these modest beginnings of four decades ago the electrical industry has grown by leaps and bounds to the high rank it holds today. Without dwelling on its numerous other branches, attention may be concentrated for the purposes of this article on electrical manufacturing as the distinct subdivision of the industry producing electrical machinery, apparatus and supplies. In 1879 the capital invested in such manufacturing amounted to only a few thousand dollars, while in 1914, according to the latest census data available on this industry, the capital was estimated as $355,725,000, this involving only factories engaged distinctively in electrical manufacturing. The value of

One Department of the Vacuum Cleaner Factory of the Frantz Premier Co., Cleveland, Ohio—Semi-Indirect Illumination Makes a Very Bright and Cheerful Workroom—Note the Large Amount of Window Surface for Effective Use of Daylight.

the products of these plants was $335,170,000 and the total number of employes and officials connected therewith was 144,712. These figures covered a year of considerable depression due to the outbreak of the European war; since that year very material increases in all these figures have taken place.

Characteristic of the many ways in which electricity enters into our ordinary, present-day business and domestic lives is the very great variety of products coming under the list of electrical manufactures. An idea of this great variety of electrical products can be obtained from the following very condensed list, which has been roughly classified into principal groups:

(1) Wires, cables, wiring fittings and supplies.

(2) Generators, transformers, switches, instruments, regulating and control apparatus, and other generating, transmitting and distributing equipment.

(3) Motors and control equipment for electric railways, cars and vehicles, and for driving heavy and light-duty machinery and appliances of all kinds.

(4) Lamps, lighting fixtures and accessories, and lighting-circuit control equipment.

(5) Telephone, telegraph, radio and other communicating and signaling instruments, exchange and line equipment.

(6) Batteries and other electrochemical apparatus.

(7) Ignition and firing equipment for automobiles, airplanes and other internal-combustion engines, heavy military and naval ordnance, mine and quarry blasting, etc.

(8) Electric heating and cooking apparatus for industrial and domestic uses of all kinds.

Each of these groups, of course, can be subdivided into a large number of individual products, but enough has been mentioned to show that the electrical manufacturer's output meets a multitude of wants. Not only are his products diversified in character, but they range in size between such extremes as the motor for developing 15,000 hp. momentarily in a reversing rolling mill and the tiny motor for dental or toy use that weighs but a few ounces. Moreover, these products include in their makeup numerous materials: Metals and alloys of many kinds; textile, rubber, glass, paper, porcelain, oil, wax and special phenolic insulations; wood, glass, hard rubber and other materials for cases and containers.

For converting this variety of materials into such a varied assortment of products requires a greater diversity of manufacturing operations than is found in almost any other industry. These include foundry work in iron, steel, aluminum, lead, brass and other alloys; machine-shop work of practically every kind from the coarse work on heavy generator or motor frames to the extremely fine and exacting work on electrical instruments of precision; wire drawing, insulating and covering; cable winding and sheathing; armature and coil winding and insulating; battery building and chemical formation; woodworking, glass blowing, clay working and many other operations usually employed in industries not directly associated with the electrical arts. In short, electrical manufacturing is an industry of many ramifications and calling for the combined skill of artisans from many crafts. The bearing of this on the subject in hand will be shown further on.

Electrical manufacturing had its modest beginnings in very small shops devoted almost entirely to the production of one product or line of products. Here the pioneer work of development was steadily pushed forward and the fruits of the early crude research and experimental work applied to the evolution of lamps, instruments and machinery. Certain of these early plants thrived and gradually increased both in size and in the variety of their products. Many others that survived continued to specialize on only one or a few lines.

Without attempting to review the history of electrical manufacturing, it may be stated that the greater capital available to the successful companies, combined with far-seeing appreciation of the value of a strong engineering and scientific staff and of persistent research, and with executive ability in organizing on a large and efficient scale, materially stimulated the growth of the big companies and led them to expand steadily. Additional products were developed and smaller manufacturing interests bought up and consolidated. Now we find the large manufacturers again tending toward specialization to a certain extent, at least by devoting certain of their works to different kinds of apparatus. The smaller manufacturing companies devote their energies for the most part to turning out only a few lines of electrical equipment in whose production they have become expert. Thus we find the industry made up of a few very large companies, a fair number of medium-sized ones and hun-

dreds of small manufacturers, the total number of establishments aggregating something like 1,000, according to census figures.

Operating and Lighting Conditions.

The great majortiy of electrical factories operate by day only, except when an occasional rush of business calls for overtime work. In a few departments of the large plants nightwork is quite common even in normal times, but in most establishments it is almost entirely unknown. From this, one would infer that the industry had relatively little need for special attention to lighting. This, indeed, is the conviction forced upon one when noting the inadequacy of the provision for lighting found in many plants, usually the smaller ones but including also some of the larger factories.

Electric motor drive is very liberally and almost universally employed in these manufactories. Electric lighting is also used almost exclusively, but in too many cases is only meagerly and inefficiently used. This seems rather strange to an electrical man, but there is an old saying about the cobbler's family being most in need of good shoes that probably explains the situation, which is surprisingly found even in some of the factories of producers of lighting equipment. The same lack of attention to lighting is found also in regard to daylight, for in many cases the windows are scanty and by no means kept clean, this being particularly true of factories located in rather old buildings.

A strange feature of this lack of lighting development is that electric lighting was the first line of electrical application to receive general use. Scarcely had the arc lamp come into service when the incandescent lamp was brought out by Edison and both these were widely employed before the motor. On the other hand, scientific knowledge of lighting requirements was almost nonexistent prior to some dozen years ago, nor were the radical lighting developments resulting in the gradual retirement of the early types of electric lamps as yet worked out. The need for intensive operation of electrical factories had also not been keenly felt, so that nightwork and accelerated production were not so urgently required as subsequently became necessary during the great period of electrification of industries and expansion of electrical supply systems. It is not surprising, therefore, that arc lamps supplemented by the older types of incandescents remained in use in electrical plants in many cases until within the present decade. Unsteadiness, lack of unreliability, sharp and deep shadows, and uneven light distribution were very common. Even when the obsolete lamps were replaced by tungsten units the change was often not made with the realization that the lighting could be very materially improved by relocation and re-equipment of the units.

By contrast, one finds in the newer and larger buildings abundant provision for the efficient use of daylight when available and for reinforcing or replacing it when it is deficient or entirely lacking, this being done in a scientifically effective and efficient manner. Illustrations of typical well lighted electrical factories are shown herewith that prove an awakening to the importance of good factory lighting on the part of progressive manufacturers.

Need for Lighting Betterment.

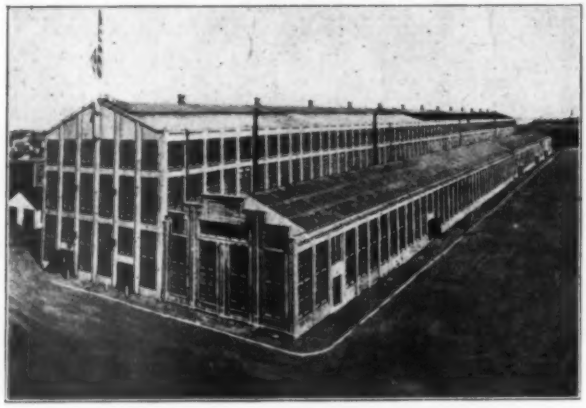
The electrical industry has developed with extreme rapidity and has just now reached the point where greater introspection of its methods may be indulged in with profit. During the period of reconstruction, all industries should investigate to find sources of inefficiency and waste in their organizations and equipment. and to ascertain wherein the adoption of improved methods and facilities will increase production capacity, improve the quality of the product and lower manufacturing costs.

It is agreed by industrial leaders of national repute that we have before us a period of unexampled prosperity; almost the whole world is hungry for our products and we are or should be in condition to produce on a scale as yet practically undreamed of. This means, first, development of manufacturing capacity to the utmost; second, improvement of efficiency in production in order to meet gradually in-

One of the Machine Shops in the Lighting Specialties Plant of the Benjamin Electric Manufacturing Co., Chicago—Mazda Lamps and Porcelain-Enameled Steel Reflectors Supply Abundant and Well Distributed Illumination.

creasing international competition; third, improvement in working conditions so as to minimize labor unrest and increase the contentment and good will of the great working classes.

Now, to the electrical industry is due a very gen-



One of the New Buildings at Lynn (Mass.) Works of General Electric Co.—This Structure Is Typical of the Most Modern Practice in Efficient Use of Natural Light—Equal Attention Is Given to Liberal and Yet Efficient Use of Artificial Light—By Night a Plant of This Type Presents, Both Outside and Inside, An Attractive Appearance of Activity and Progressiveness.

erous share in this prosperity. The call for electrical products has steadily increased, in times of prosperity this increase being greatly accelerated. During the war, electrical like other developments have been checked. Deferred demands for motors, lamps, wiring fittings, and the multitude of other electrical supplies must be met. The raw material situation is gradually clearing up and the dearth of labor may be relieved by the returning soldiers. At any rate, manufacturing conditions are already, or presently will be, improving. Should the labor shortage continue, the need for the highest efficiency will be the keener.

This then is the psychological time for the electrical manufacturer to put his house in order to prepare for more strenuous business demands. It would not be surprising if these should require a considerable increase of night or overtime operation of factories. To permit this to be carried on efficiently requires the best possible artificial lighting, which at the same time eliminates the interference with production from cloudy weather or the darkness of early mornings and late afternoons in autumn and winter months. It should also be noted that in some departments continuous operation, 24 hours a day, very decidedly increases the efficiency and in all cases it serves to reduce the proportion of the fixed charges on the investment to the total production cost.

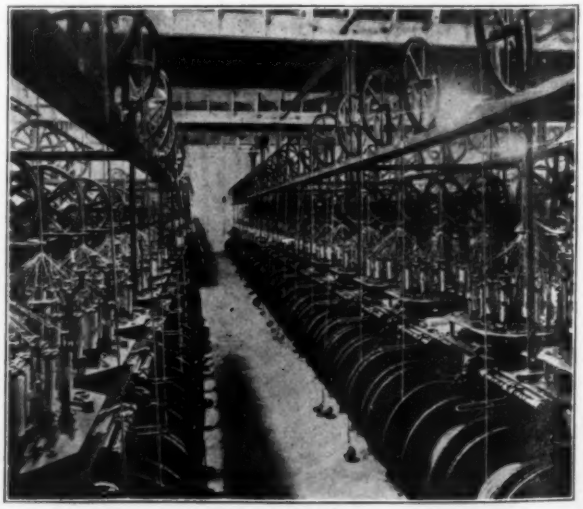
The installation of good lighting has invariably resulted in increase of production rate through better visual conditions, elimination of time losses and enhanced all-around efficiency of the workers. It has also improved the quality of the product and reduced the spoilage of material. Further, it has very materially improved working conditions, diminished labor turnover and increased the contentment of employes. These and other features will be commented on below, but it suffices here to point them out as important plain business factors to be taken into account, in addition to the reasons already mentioned, for giving timely consideration to the question as to whether the lighting facilities now provided are of a type and extent that may reasonably be expected in so progressive an industry as the electrical.

Advantages of Improved Factory Lighting.

The agitation for improvement in factory lighting is less than ten years old and its effects are becoming increasingly manifested. There are many manufacturers, however, and among them quite a few electrical, who have given but little attention to it and who are not "sold" on its necessity. For their benefit it may be well to summarize its principal advantages briefly. It should be noted that these are not based on isolated instances, but are found in every plant in which the lighting has been modernized along what is regarded as the best practice from the standpoint of both visual and physical efficiency. These advantages may be stated as follows:

Increased production.
Improved quality and diminished spoilage.
Better order and supervision.
Reduced accidents.
Diminished eye strain.
Better working conditions.
Increased contentment.

Difficulty in seeing the work always slows up if it does entirely stop production. This is especially true of intricate operations where fine detail must be observed and can be noted in any plant where the lighting is very meager on a dark winter morning, for instance, just after the men have come on duty. As the lighting improves, so does the production. Obviously, provision of artificial lighting to such extent as to never leave the workers without abundant light for seeing their tasks should be the means of increasing the production rate through eliminating all the time lost in groping about for proper tools or materials, in setting gauges and adjusting machines, etc. This increase in production is actually found to range from 5 to 25% or even more, depending on how miserable the former lighting was. This is a vital



Braiding Department of the Detroit Insulated Wire Company Plant—Mercury-Vapor Lamps Furnish Evenly Distributed Illumination Free From Troublesome Shadows.

advantage of improved lighting and is usually regarded as alone furnishing ample justification for the moderate outlay of a first-class lighting system. Careful tests indicate that an average increase of 15% in production may be obtained at a cost of about 5% of the payroll.

Assembling Room in Electric Washer Department, Hurley Machine Co., Chicago—Good Illumination From Mazda Lamps With Porcelain-Enameled Steel Dome Reflectors.

Quality in electrical products is often the difference between a satisfactory and an unreliable piece of apparatus, one whose insulation may break down just when most awkward. Care in manufacture, inspection or testing, and in packing is enhanced by good lighting so that defects in insulation, assembling, or any other respect are not so likely to happen as when the work is done in semi-gloom or utter darkness. A vast amount of material is annually spoiled and absolutely lost through difficulty in seeing the work properly. Modern lighting eliminates this loss almost entirely and it reduces the "seconds" which constitute another heavy loss. A firm that prides itself on quality will find good lighting a paying investment on this score alone.

A plant that is meagerly lighted is usually one that is kept in rather poor order and in which proper supervision is difficult. Good lighting floods the premises with illumination that makes for orderly arrangement and movement of materials, that prevents accumulations of stock, wastage or rubbish, in out-of-the-way places, and which enables the foreman and superintendent to easily keep track of the work and the workers. In a plant where intricate parts are handled or where the plant layout is not simple, this is an important consideration.

All industrial occupations involve some accident hazard and this is greatly increased where electrical testing at any but very low voltages is done. The best possible illumination is necessary to expose this hazard. But even for such common accidents as falls, minor cuts and bruises, good lighting reduces the accidents substantially. In spite of "Safety First" work conducted for many years, it is held that poor lighting is the preventable cause of some 18% of all industrial accidents and incapacitates a vast army of workers every year.

Eye strain is one of the most serious evils of industrial work, because it results in not only reducing the efficiency of the worker to his employer, but in frequently throwing him upon the charity of the community due to his impaired vision and earning capacity. Inadequate lighting is a prolific cause of continued eye strain and injury to the eyesight, but so also is improper lighting, that is, neglect of the principles of scientific illumination, especially by forgetting to eliminate glare. Provision of modern lighting prevents this impairment of eyesight and maintains the worker's visual efficiency.

It also makes the workroom cheerful and removes the depression commonly found in gloomy factories whose workers have a dejected and sleepy aspect. Cheerful surroundings make the employes alert and keen and have a psychologically stimulating influence, especially on women employes who have become so numerous in many departments of electrical manufacture. The improvement in working conditions due to better lighting is substantial, although very difficult to express on a percentage basis.

Another factor of much importance is the increased contentment of the workers in a well lighted factory. This is due to a combination of the foregoing features, reduced accidents, decreased eye strain and improved working conditions. The employes are quick to observe that the management is solicitous for their welfare and this makes for a more contented and stable organization. The trouble and expense of high labor turnover is reduced and the liability of labor disputes diminished. All these humanitarian considerations, therefore, call for careful attention to the subject of lighting betterment.

Developments in Lighting Equipment and Practice.

To electrical men it should hardly be necessary to review the very important developments in electric lamps and accessories and in the practice of industrial lighting that have taken place in the last dozen years. And yet there are among the executives of electrical manufacturing plants not a few who apparently have not realized that rapid progress has been made in this line, some indeed being too engrossed in their own developments to keep fully in touch with those of other branches of the industry. For their benefit it may be well to call attention to only a few points.

One is that present factory lighting practice has abandoned the use of all arc lamps except the mercury-vapor tube and of all the old incandescents; the tungsten-filament lamp is now the best incandescent in service and wherever possible the gas-filled type of this lamp is employed because of its higher efficiency.

With the old arc and carbon-filament lamps reflectors were not very generally used, because they were not so necessary and had been only imperfectly

developed. In present practice a good reflector is considered to be an essential part of every industrial lighting unit. It should accomplish two things: Redirect into useful directions the light that would be wasted in directions where not needed or desired, and cut off from the source itself the direct brilliant light that would strike the eye at angles near the horizontal. The first function improves the physical efficiency of the unit, the second improves its visual or physiological efficiency by reducing the glare that hampers vision. In many units special means are taken to reduce or eliminate glare by use of diffusing glass caps, bands or bowls or by means of special reflector caps.

Electrical manufacturers can easily obtain the advice and help needed in working out their lighting problems from the engineers of their associates—the manufacturers of electric lamps, reflectors and other lighting equipment. Their lighting problems are varied because of the many different operations carried on, but can readily be worked out. An idea of the best intensities to use for different operations and departments is given in the adjoining table of recommendations from the Factory Lighting Code of the Illuminating Engineering Society. These values are conservative and in many cases can be greatly exceeded.

To do so requires taking advantage of the latest developments in electric lighting practice. Moreover, it requires remodeling or rehabilitation of the lighting system from time to time so as to replace the obsolete with the products of the best scientific and commercial skill in the lighting industry. Lighting experts estimate that there are continually being brought about developments in lighting equipment and practice to warrant at average intervals of five years a rearrangement or re-equipment of the lighting facilities of any industrial plant, and especially so of a plant like that of an electrical manufacturer that should be the acme of all that is fully up to date.

Co-operative Obligation to Improve Lighting.

Electricity and things electrical are now coming to be more and more closely associated in the public mind with the modern and progressive. This status has been well merited by the extraordinary achievements that electricity has been able to effect in so short a period as 40 years. While the electrical industry primarily created the foundation for this popularity of things electrical, it has largely grown without stimulation and far beyond the dreams of electrical pioneers.

The manufacturer must fully modernize his plants as to power and lighting equipment and avail himself of the developments in other lines of his industry. The war has stimulated co-operation in nearly all industries. Electrical men have long talked of it. It should be carried out further, certainly at least to the extent that a wire or motor manufacturer, for instance, will utilize the improvements brought about by his fellow lamp and reflector manufacturer. The former expects the latter to use his latest products liberally. Reciprocal obligations should obtain, especially in view of the fact that it is to the pecuniary interest of any manufacturer to use the most efficient methods and equipment.

Again, reverting to the public's viewpoint, it may be said that formerly it was the plant with many smoking chimneys that was considered to be the busiest and most progressive. Nowadays a smoking chimney is no longer the symbol of true activity, but of poor efficiency. The modern busy plant is the one that is fully electrified and shows by its scientifically illuminated buildings that it is active, alert and progressive.

TABLE OF ILLUMINATION INTENSITIES FOR DIFFERENT MANUFACTURING OPERATIONS AND DEPARTMENTS.

	Areas or kind of work to be illuminated.	Foot-candles at the work. Ordinary practice.	Minimum.
A	Roadways and yard thoroughfares.	0.05— 0.25	0.02
B	Storage spaces	0.50— 1.00	0.25
C	Stairways, passageways, aisles.....	0.75— 2.00	0.25
D	Rough manufacturing, such as rough machining, rough assembling, rough bench work	2.00— 4.00	1.25
E	Rough manufacturing, involving closer discrimination of detail...	3.00— 6.00	2.00
F	Fine manufacturing, such as fine lathe work, pattern and tool making	4.00— 8.00	3.00
G	Special cases of fine work, such as watchmaking, drafting	10.00—15.00	5.00

General View in Wire-Braiding Department of Belden Manufacturing Co., Chicago—Photograph Taken in Afternoon Shows Both Natural and Artificial Illumination Combined—Mazda Lamps and Silvered Glass Reflectors Are Used for Efficient Lighting.

Economic Operation of Steam Turbo-electric Stations—II.

Bureau of Mines Technical Paper Discussing Fuel Economy Factors, Load Distribution Between Units, Boiler-Room and Auxiliaries Operation—Second Installment

By T. C. HIRSHFELD and C. L. KARR

Boiler-Room Operation.

The boiler-room operation, like turbine-room operation, should be based upon the characteristic curves of the apparatus available. Here the characteristic curve of importance is one showing the values of the combined efficiency of the boiler unit at all different loads within its operating range. By combined efficiency is meant the value obtained by dividing the heat supplied the material passed through the boiling vessel in a given time by the total heat in the fuel passed through the furnace in the same time.

This curve has a characteristic contour; it is always domed like the curves shown in Fig. 4. The exact shape of the curve, its height, and its extension to left and right vary with the proportions and type of apparatus and can be determined only by careful experiment in each case.

The word careful is used advisedly. In the first place, accurate water measurements and accurate coal measurements are necessary. Second, careful sampling and analysis of coal are essential. And, third, the tests must be conducted with full appreciation of the differences between operating conditions and test conditions as ordinarily understood.

If the tests are to be of maximum use in the operation of the boiler room they should not be run under conditions that would be expected to give results better than those attainable with the exercise of the average amount of skill and patience of the operating crew in the daily routine of plant life. Tests made under better conditions are interesting as showing results toward which to aim, but they have not the same utilitarian value as tests made under conditions that as nearly as possible represent the best that can be reasonably expected as maintained performance.

For example, the water-washed surfaces of the boiler should be in average condition; that is, covered with about the quantity of scale and mud that would be expected about halfway between cleanings. Again, the gas-washed surfaces should be cleaned to the same extent and at the same time intervals as in daily routine operation. Further, the fireman or operator should not be the best, nor the poorest available; he should represent about the average operator in the plant.

Tests run under such conditions may not give results approaching advertised records but they have the virtue of telling very nearly the average truth with regard to possible operating results.

The upper curve, given in Fig. 4, represents good practice with large boilers operated without economizers and with underfeed stokers a little larger than the average for a given amount of boiler surface. The values shown could be obtained under operating conditions, with skillful operators, supplied with complete sets of instruments for guiding them in making of adjustments. It is probable, however, that few operating crews could be kept so very efficient as to maintain conditions giving a curve of this height. Values 2 to 3% lower would in most cases represent extremely good practice. The great majority of operating crews would probably obtain curves from 5 to 10% below that shown.

Whatever the actual height, the general shape of the curve for stoker-fired boilers should not be very different from that illustrated. This shape is of great importance. It will be noted that the efficiency falls off much less rapidly at loads above that giving the greatest efficiency than it does at loads below that point. Moreover, the dome is relatively flat, and fairly large variations of load near the best point can be obtained without very great variations in thermal efficiency. In the case illustrated, an efficiency of 75% or better is obtainable between about 70 and 190% of rating, and 78% or better is obtainable between about 85 and 160% of rating.

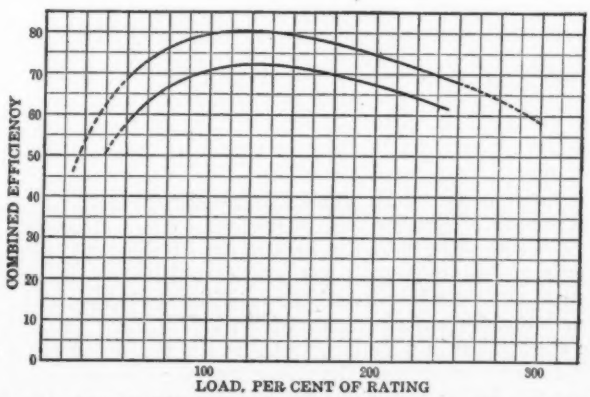


Fig. 4.—Curves Showing Combined Efficiency of Boiler Unit at Different Loads.

The most economical thermal results are obviously obtainable when such a number of boilers is operated as will require those operating to carry loads near that giving the best point on the curve. It is equally evident that when swinging loads are considered it is best to have the average load on a boiler fall above rather than below the best point because of the less rapid drop of the right-hand side of the curve.

Economic considerations, other than those involving the cost of fuel, also dictate average operation at a point above that giving the highest thermal efficiency. As regards apparatus of the type assumed in obtaining the curve in Fig. 4 an average load near 140% of rating would probably give about the best

compromise under normal central-station conditions, unless fuel was far above average prices.

Two further modifying conditions must also be noted in this connection. First, it may be necessary to operate in such a way that peak loads of large size can be picked up quickly on boilers already in operation. This may dictate operation at a point lower on the curve than would otherwise be chosen. Second, the character of the station load may be such that very light loads must be carried during many hours out of the twenty-four. This may dictate average operation at a higher point on the curve than would otherwise be chosen, in order that all of the boilers operating can follow the load downward for a considerable distance before banking of any boilers is required.

Banking of boilers should be carefully studied in every case. A certain definite quantity of coal is consumed during every banking period and this quantity can be determined by experiment. It is, therefore, actually possible to determine at what point in the characteristic curve it is more economical to bank one or more boilers than to carry all at a lower rating.

For instance, assume a station containing 10 boilers, each rated at 600 boiler horsepower. Assume further that all ten are operated at moderate loads above rating during the day and early evening, and that later the load on the plant drops to a point which requires 3000 boiler horsepower for its operation.

This load could be carried in any one of the following ways:

10 boilers working at 50% of rating;
9 boilers working at about 55.5% of rating;
8 boilers working at about 62.5% of rating.
7 boilers working at about 71.5% of rating;
6 boilers working at about 83.5% of rating;
5 boilers working at rating;
4 boilers working at 125% of rating; or
3 boilers working at about 166% of rating.

The operator must determine which one of these various possible arrangements gives the best results. A first tentative decision may be made on the basis of fuel economy and then the effect of other relevant matters may be considered.

Calculation of Thermal Costs.—Before any calculations can be made it is necessary to know the fuel cost of banking and the heat value of the coal. Assume, therefore, that it has been found by experiment that it costs 0.2 lb. of coal per rated boiler horsepower, per hour, for the character of bank that must be used in the station in question, and that the fuel used has a heat value of 13,500 B.t.u. per pound; assume, also, that the lower curve of Fig. 4 represents the characteristics of the boilers under consideration; then, if a boiler horsepower is assumed to be equivalent of 33,479 B.t.u., it becomes possible to tabulate the thermal costs for all the possible cases, as follows:

1. Operation of 10 Boilers at 50% of Rating.

The curve assumed indicates an efficiency of about 57.5% at this loading, therefore

Heat supplied operating boilers per hour $= \frac{3{,}000 \times 33{,}479}{0.575} = 174{,}673{,}000$

Heat supplied banked boilers per hour = 0

Total heat supplied per hour = 174,673,000

2. Operation of 9 Boilers at 55.5% of Rating.

The curve assumed indicates an efficiency of about 60% of this loading, therefore

Heat supplied operating boilers per hour $= \frac{3{,}000 \times 33{,}479}{0.6} = 167{,}395{,}000$

Heat supplied 1 banked boiler per hour $= 600 \times 0.2 \times 13{,}500 = 1{,}620{,}000$

Total heat supplied per hour = 169,015,000

3. Operation of 8 Boilers at 62.5% of Rating.

The curve assumed indicates an efficiency of about 63% at this loading, therefore

Heat supplied operating boiler per hour $= \frac{3{,}000 \times 33{,}479}{0.63} = 159{,}423{,}000$

Heat supplied 2 banked boilers per hour $= 2 \times 600 \times 0.2 \times 13.500 = 3{,}240{,}000$

Total heat supplied per hour = 162,663,000

4. Operation of 7 Boilers at 71.5% of Rating.

The curve assumed indicates an efficiency of about 65.2% at this loading, therefore

Heat supplied operating boilers per hour $= \frac{3{,}000 \times 33{,}479}{0.652} = 154{,}044{,}000$

Heat supplied 3 banked boilers per hour $= 3 \times 600 \times 0.2 \times 13{,}500 = 4{,}860{,}000$

Total heat supplied per hour = 158,904,000

5. Operation of 6 Boilers at 83.5% of Rating.

The curve assumed indicates an efficiency of about 68.2% at this loading, therefore

Heat supplied operating boilers per hour $= \frac{3{,}000 \times 33{,}479}{0.682} = 147{,}268{,}000$

Heat supplied 4 banked boilers per hour $= 4 \times 600 \times 0.2 \times 13{,}500 = 6{,}480{,}000$

Total heat supplied per hour = 153,748,000

6. Operation of 5 Boilers at Rating.

The curve assumed indicates an efficiency of about 71% at this loading, therefore

Heat supplied operating boilers per hour $= \frac{3{,}000 \times 33{,}479}{0.71} = 141{,}461{,}000$

Heat supplied 5 banked boilers per hour $= 5 \times 600 \times 0.2 \times 13{,}500 = 8{,}100{,}000$

Total heat supplied per hour = 149,561,000

7. Operation of 4 Boilers at 125% of Rating.

The curve assumed indicates an efficiency of about 72% at this loading, therefore

Heat supplied operating boilers per hour $= \frac{3{,}000 \times 33{,}479}{0.72} = 139{,}496{,}000$

Heat supplied 6 banked boilers per hour $= 6 \times 600 \times 0.2 \times 13{,}500 = 9{,}720{,}000$

Total heat supplied per hour = 149,216,000

8. Operation of 3 Boilers at 166% of Rating.

The curve assumed indicates an efficiency of about 70% at this loading, therefore

Heat supplied operating boilers per hour $= \frac{3{,}000 \times 33{,}479}{0.70} = 143{,}481{,}000$

Heat supplied banked boilers per hour $= 7 \times 600 \times 0.2 \times 13{,}500 = 11{,}340{,}000$

Total heat supplied per hour = 154,821,000

Obviously methods 6 and 7 are practically equivalent from a thermal viewpoint and are thermally more efficient than any of the other combinations. If no other considerations led to a different result this plant should therefore bank five or six boilers at night.

From the preceding paragraphs it should be apparent that it is possible to base the running of a boiler room on characteristic curves in much the same

way as was shown to be possible with the turbine room. However, there is a most essential difference between the two kinds of apparatus. A turbogenerator automatically reproduces a given thermal efficiency at a given load under given conditions of pressure, superheat and vacuum, but there is nothing automatic about a boiler. The reproduction of results which have been found possible in a boiler room requires the constant attention of a skilled and appreciative operator, one who understands and who has the patience and persistence required to make numerous adjustments at frequent intervals. The greatest savings can generally be effected by so picking and so training the boiler-room crew that the results of daily operation practically duplicate what has been found possible during tests conducted under such conditions as were outlined in an earlier paragraph.

Experience has shown that one of the best methods of keeping a boiler-room crew up to the proper working level is to determine average boiler efficiency for each week or each month of operation and to acquaint them with the results. Such efficiencies are easily calculated with a reasonable degree of accuracy if the coal is weighed and the feed water is metered. Equipment for such purposes should form an integral part of every modern station.

Operation of Auxiliaries.

In steam power-plants power is required for running a number of auxiliaries, such as coal-handling apparatus, stokers, boiler-feed pumps, circulating pumps, etc. The methods used for obtaining this power are determined as a compromise between reliability, convenience, thermal economy and financial economy.

Before the various methods available are considered it is desirable to call attention to several impressions that are widely held, although they are only partly true. Thus it is often assumed that steam-driven auxiliaries are thermally the most economical because the steam exhausted from auxiliary drives can be used in heating the feed water. Again, others hold that electric drive is thermally the most economical arrangement because the power used by the auxiliaries is generated in the main units of the station and these are unquestionably far more efficient than the scattered small units that would be used for direct steam drive. Similarly, there are several other equally comprehensive statements of supposed facts with regard to auxiliary drive that are just as mutually contradictory.

As a matter of fact, no broad statements of the type indicated above can be true in general. Each method available is adapted to the solution of certain problems and it generally results in practice that a compromise must be made between several methods to obtain the best results. Certain fundamentals can be laid down, however, and may be used as guiding principles for making a choice between possible methods in planning a new installation, or as indications of the best methods of operating stations already constructed. Often a study of operating conditions in the light of these fundamentals will show that it would pay handsomely to alter the auxiliary machinery in existing plants.

"Straight" Steam Drive.—What may be designated as the unmodified or "straight" steam method of auxiliary drive is illustrated diagrammatically in Fig. 5. The width of the stream as shown by the dimension A represents the total amount of heat supplied the boiler. Of this, a part is lost at the boiler, and a part is lost in steam lines and traps, and a part enters the main unit. The remainder finally arrives at the auxiliary machinery, where it is split into three parts: (a) The auxiliary power sought; (b) losses by radiation, friction, windage, etc.; and (c) heat in the exhaust steam. The heat in the exhaust steam is returned to the boiler by being absorbed in the feed water, and thus it forms part of the width of the stream as indicated by A. If it were not returned in this way the part of the stream representing heat in fuel would have to be wider by the amount indicated by B in the figure.

The heat in the exhausted auxiliary steam really travels around in a short-circuited path as indicated. It joins the stream going to the auxiliaries, thus increasing its width, and continuously comes back and starts again.

As a rough approximation, auxiliary power obtained in this way may be said to cost about 4500 B.t.u. per kilowatt-hour of auxiliary power. This figure is obtained as follows: One kilowatt-hour is equivalent to 3412 B.t.u., and the net cost of obtaining this with the method shown in Fig. 5 is 3412 B.t.u. plus some boiler losses, steam-pipe losses, and radiation, friction and windage losses chargeable to 1 kw-h. of auxiliary power. The total is ordinarily not much different from 4500 B.t.u. in fuel per kilowatt-hour of auxiliary power.

It must be noted that this figure holds only for conditions under which the steam exhausted from auxiliaries can be absorbed by the feed water. If a condition arises in which auxiliary exhaust must be discharged to the atmosphere, the auxiliary power must be charged with the heat in its exhaust steam, and a kilowatt-hour generated under these conditions involves an expenditure of 50,000 to 200,000 B.t.u.

It is now possible to demonstrate the fallacy of a common statement to the effect that the economy of the steam engines or turbines used for driving auxiliary apparatus makes no difference in the economy

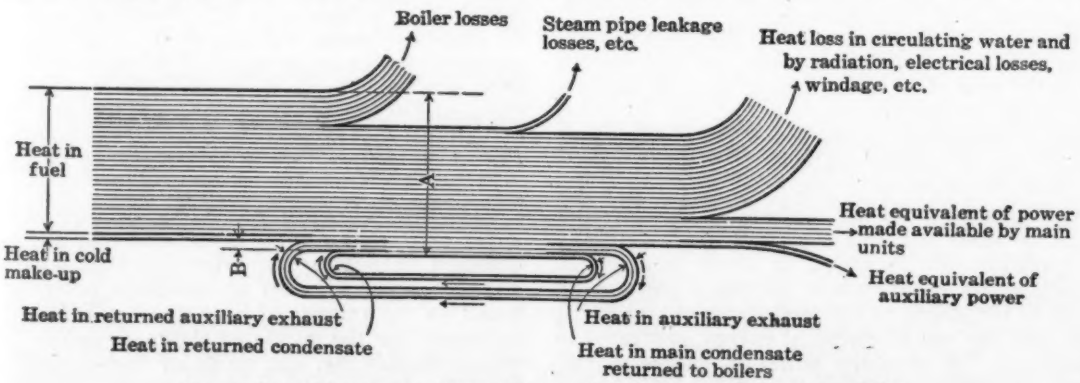

Boiler losses
Steam pipe leakage losses, etc.
Heat loss in circulating water and by radiation, electrical losses, windage, etc.
Heat in fuel
A
Heat equivalent of power made available by main units
Heat in cold make-up
B
Heat equivalent of auxiliary power
Heat in returned auxiliary exhaust
Heat in returned condensate
Heat in auxiliary exhaust
Heat in main condensate returned to boilers

Fig. 5.—Heat Diagram for Unmodified or "Straight" Auxiliary Steam Drive.

of the plant. In plants of modern proportions the amount of auxiliary power required per kilowatt capacity of main units is such that at light and moderate loads much more auxiliary steam would be made than could be absorbed by the feed water. It therefore follows that if a straight steam-driven auxiliary system is adopted, the greatest thermal efficiency will result when the most efficient engines or turbines are used for driving auxiliaries. Whether the use of such efficient, and therefore costly, auxiliary drives would result in the greatest economic efficiency would depend entirely upon the costs of fuel and capital. Ordinarily, the fuel saving would be such as to balance a very considerable increase in first cost.

"Straight" Electrical Drive.—The direct opposite of what has been called the unmodified steam method will be designated as the unmodified or "straight" electrical method. In this method all auxiliaries are motor driven and the power is taken from the main units served or from the station bus. Turbine plants of modern design should produce a kilowatt-hour with an expenditure of 19,000 to 25,000 B.t.u. in coal. Therefore every kilowatt-hour taken for the driving of auxiliaries represents a thermal cost of the order of 23,000 to 30,000 B.t.u., after allowing for the various efficiencies involved.

The unmodified electrical method possesses many advantages, such as reliability, simplicity, flexibility, cleanliness, and such, but it is unquestionably thermally expensive as compared to the other method under conditions that permit total absorption of the exhaust. On the other hand, the thermal cost of auxiliary power generated without reclamation of the heat in the exhaust is two to eight times as large as that characteristic of the "straight" electrical method.

In some of the stations installed a decade or more ago the auxiliary problem was solved by the use of both steam and electrically driven units. This may be designated as the dual system. A sufficient number of steam-driven auxiliaries were operated to give that quantity of exhaust steam which could be absorbed by the station feed, and all of the remaining auxiliary power was obtained electrically with energy taken from the main units. Many systems of this sort are in successful operation.

Obviously, the correct apportionment between the two different methods in the dual system varies with the station load. With high loads and large quantities of feed water the greater part of the auxiliary power is obtained with steam, and with light loads a large part is obtained electrically. Consequently the thermal cost of auxiliary power varies with the load. At high loads this cost tends to approach the 4500 to 5000 B.t.u. characteristic of steam drive with utilization of exhaust, and at light loads it tends to approach a figure nearer 20,000 to 30,000 B.t.u.

Following the development of the dual system came many schemes of various sorts for still further reducing the cost of auxiliary power and for increasing operating convenience.

Other Systems for Driving Auxiliaries.—One such system drives the auxiliaries electrically with power taken from the main units and heats the feed water with steam drawn from the medium or low pressure stages of the main turbines. This system is capable of many variations but in all of its forms it amounts, thermally, to the generation of auxiliary power with steam up to the ability of the feed water to absorb the exhaust, and the use of electrical energy generated in the main unit for auxiliary power in excess of this quantity. However, as the main units are the source of the steam-generated part of the auxiliary power, the steam drives of the auxiliaries are very economical and a larger proportion of auxiliaries can be driven in this way than could be done if many small steam-driven units were used. Moreover, all advantages of "straight" electrical drive are obtained and the operation of the system is delightfully simple. The different demands made by the feed water at different loads can be met by merely controlling the steam bled from the lower stages of the turbine. By placing the bleeder valves under thermostatic control the operation can be made entirely automatic.

The thermal cost of auxiliary power with this arrangement is similar to that of the dual system, but with normal load curves it should be lower through the greater thermal efficiency of the apparatus used for furnishing the "steam-driven" part of the auxiliary power. Because of the greater thermal efficiency, a smaller number of pounds of "exhaust" steam will be made per unit of auxiliary power generated and a greater part of the total can therefore be generated in this way without exceeding the ability of the feed water to absorb "exhaust" steam.

Another system that has been used extensively is almost the opposite of that last described. The auxiliary apparatus is driven by numerous small steam-operated units. As much as possible of the steam exhausted by these units is absorbed in the feed water and the remainder is fed to the low-pressure stages of the main turbines. By the use of an automatic valve on the auxiliary exhaust the apportionment of exhaust steam can be made automatic in operation; in this respect the system behaves similarly to that last described.

It is obvious that whatever part of the auxiliary power is derived from steam that is later absorbed by the feed water is obtained at the thermal cost characteristic of a "straight" steam system. As the steam drives of the auxiliaries are bound to be of small capacity they are commonly characterized by low thermal efficiency and therefore use a relatively large quantity of steam per kilowatt-hour developed. In this respect the system is less economical than that previously described, because with absorption of exhaust steam by the feed water a smaller part of the total auxiliary demand can be supplied.

A consideration of the thermal cost of that part of the auxiliary power obtained from steam exhausted into the main units is more complicted. In general, it can be assumed that about half of the energy made available by steam expanding from boiler to condenser pressure in modern turbines is developed during the expansion from boiler pressure to atmospheric pressure. The other half is produced by the expansion from atmospheric pressure to the back pressure maintained at the turbine exhaust. Therefore, every pound of auxiliary steam exhausted at about atmospheric pressure into the lower stages of the main turbines may be said to make available at the main generators about the same amount of energy as would be made available by half a pound of steam entering at the high-pressure end of the main turbines and expanding to condenser pressure.

The thermal cost of auxiliary power obtained from steam exhausted into the main units may obviously be obtained by subtracting from the heat supplied the auxiliaries per kilowatt of auxiliary power a credit based on the amount of heat that has been made unnecessary for the supply of the main units. Thus, if the auxiliaries use, say, 50 lb. of high-pressure steam per kilowatt-hour of auxiliary power generated, this

steam exhausted into the main units will take the place of 25 lb. of main steam. The net cost of 1 kw-h. of auxiliary power would then be the heat above feed temperature in 25 lb. of high-pressure steam.

With feed at 210° F. and modern pressure and superheats, the quantity of heat thus chargeable per pound would be in the neighborhood of 1100 B.t.u. In the assumed case the auxiliary power would therefore cost about $25 \times 1100 + 27{,}500$ B.t.u. per kilowatt-hour. With more efficient auxiliary drives this figure would be lowered and with less efficient auxiliary drives it would be raised.

The values assumed are somewhat lower than would be expected in the average practice, and it is obvious that, in general, this method of obtaining auxiliary power may be expected to be slightly more costly than that last described.

Conclusions.—A careful consideration of all the methods described thus far warrants these conclusions:

1. The smallest thermal cost for auxiliary power is incurred when generated by steam with complete absorption of the exhaust in the feed water.
2. The greatest possible part of all of the auxiliary energy required can be obtained in this way when the steam drives used with the auxiliaries have the greatest possible thermal efficiency.
3. Auxiliary power in excess of that obtainable with exhaust steam absorption can be procured from the main generators in electrical form at a lower thermal cost than in any other way.

To these conclusions may now be added two commonly known facts:

1. The increasing price of fuel is leading more central stations to the use of economizers.
2. The greatest saving is effected with economizers when the water supplied them is at the lowest permissible temperature. This value is probably somewhere between 120 and 150° F., depending upon the types of economizer used and the care with which it is operated.

At first glance some of the items listed in the two groups seem contradictory when viewed with regard to thermal efficiency. Thus the use of feed water at 140°F., say, must reduce the quantity of auxiliary steam that can be used for feed-water heating and must therefore increase the average cost of auxiliary power. However, when all of the listed items are taken into account they point toward another solution of the auxiliary power problem which has been found both thermally efficient and very practical.

It is obvious that fairly high thermal economy is more readily obtainable with one turbine of moderate size than with a great number of small turbines aggregating the same capacity. It is also obvious that, if the turbine is properly designed, the quantity of steam required by it at any given load will decrease as the back pressure is decreased.

With the system referred to, all, or practically all, of the auxiliaries are electrically driven, but as much as possible of the electric power used is taken from an auxiliary, steam-driven generator of fairly large size. The remainder is taken from the main unit. Steam exhausted by the auxiliary turbogenerator unit is passed into a feed-water heater as in the "straight" steam method, but the feed-water heater is arranged so that it can be operated at a pressure below atmospheric if desired.

The feed-water heater therefore may serve as a condenser so far as the auxiliary turbine is concerned and the water rate of the auxiliary turbine may thus be lowered still further, with reference to the aggregate water rate of a number of small steam units.

This system is thermally the exact counterpart of the dual method previously described. It is, however, thermally superior in that the greater efficiency of the large auxiliary unit makes possible the absorption of the steam made from the generation of a larger part of the total auxiliary power. It is also superior in that a control of the auxiliary steam made is available, for, with any given load, the quantity of steam demanded depends entirely on the back pressure.

These points of superiority can be utilized in two ways. The auxiliary unit may be operated with atmospheric-exhaust pressure, when the advantage gained is merely that of being able to carry a greater part of the total auxiliary load on the steam-driven auxiliary apparatus. Or the auxiliary unit may be operated with low back-pressures, so low as to give feed-water temperatures as low as 140° F.; in this case economizers can be used to full advantage and a greater part of the auxiliary power can be carried on steam-driven machinery than would be permissible with a number of small steam-driven units exhausting at a corresponding temperature.

Thermally, the cost of auxiliary power is approximately 4500 to 5000 B.t.u. for all that power obtained from the auxiliary generator, and all power in excess of this is obtained from the main generator at a thermal cost of 23,000 to 30,000 B.t.u.

From this hasty survey of the methods of obtaining auxiliary power, and the possible costs of auxiliary power it should be evident that large errors can be made in the original design. It is also possible to make costly errors in operation. To illustrate: Assume that in a certain station, operating at normal day load, the total amount of power used for auxiliaries and for house service of all kinds amounts to 10% of that sent out. This is a figure that should not be exceeded but is often equaled. Under these conditions, for every 1000 kw-h. sent out of the station it is necessary to produce 100 kw-h. for the operation of auxiliaries, station lights, etc.

If it be assumed that the main units are capable of producing a kilowatt-hour for 20,000 B.t.u. in fuel fired it is possible to show the decidedly weighty influence of the thermal cost of auxiliary power.

It has been shown that auxiliary power may cost anywhere between about 4500 and 200,000 B.t.u., depending on the method used. At 4500, the auxiliary power would cost about $4500 \times 100 = 450{,}000$ B.t.u. in the assumed case. This would be equal to about 2.25% of $20{,}000 \times 1000 = 20{,}000{,}000$ B.t.u. required by the main units. On the other hand, if the auxiliary power costs 200,000 B.t.u. per kilowatt-hour, the total would be $200{,}000 \times 100 = 20{,}000{,}000$, or exactly the same as that required by the main units.

With all auxiliary power taken electrically from efficient main units the cost would probably be at least 23,000 B.t.u. per kilowatt-hour. This would give a cost in the assumed case equal to $23{,}000 \times 100 = 2{,}300{,}000$, or about 11.5% of that required by the main units for the generation of power leaving the station.

These figures should serve to show the tremendous importance of the proper operation of auxiliary machinery. It does little good to determine the water rates of the main units and operate for a minimum station water rate of these alone, as suggested in the first part of this paper, if the thermal savings effected are equaled or more than equaled by losses through wrong operation of auxiliary systems. Further, the tendency to regard these auxiliary systems as neces-

sary nuisances of no great thermal significance is very apt to lead toward such a state.

In conclusion, as much as possible of the auxiliary power should be obtained in such a way that resultant exhaust steam can be absorbed by the feed water. The remainder of the necessary auxiliary power should be obtained in electrical form from the most efficient units available. The observance of these two rules leads to maximum thermal economy.

The exact method adopted for achieving these desirable results must depend upon the layout and the characteristics of the particular station. No one system is pre-eminently superior under all conditions. However, it should be noted that the possibilities of a system often can be greatly increased by making comparatively insignificant changes along lines suggested in the preceding discussion.

WATER POWER ON ST. LAWRENCE RIVER.

Vast Potential Sources of Hydraulic Power Are Emphasized.

In a paper entitled, "Canada's Heritage in the St. Lawrence River," read before The Electric Club, Toronto, Arthur V. White, consulting engineer, summarized the water powers in the St. Lawrence River as follows:

WATER POWER ON THE ST. LAWRENCE RIVER*

(Tentative schedule.)

Site	Head available.	Estimated low-water 24-hr. hp.	Average estimated 24-hr. low-water hp.
Morrisburg-Rapide Plat...	11-15	170,000-230,000	200,000
Long Sault Rapid.....	30-40	500,000-650,000	575,000
Coteau Rapid	15-17	230,000-260,000	250,000
Cedars Rapid†	30-32	490,000-525,000	500,000
Split Rock and Cascades Rapids	14-18	220,000-280,000	250,000
Lachine Rapid	20-30	300,000-450,000	375,000
Total	.....	1,910,000-2,395,000	2,150,000

*In this table, to have the estimates fairly representative of the possible quantities which might be expected under representative low-water flow conditions, some allowances have been made for efficiency and other factors.

†Under development for about one-third of the low-water flow of the river. Consideration would be given to the possibility of combining the Coteau, Cedars, Split Rock and Cascades; also of increasing the Lachine power.

The above estimate, excluding ice conditions, is conservative. Under a "diversity load factor," such as is experienced by the Hydroelectric Power Commission of Ontario, Canada's 1,800,000 hp. would take care of a power demand of some 2,400,000 hp.

Canada's share of this power belongs respectively to the provinces of Ontario and Quebec. The federal government has the rights in and jurisdiction over navigation. When the time comes for international questions in connection with the development of this river to be adjusted to admit of proper development, there is no doubt that the various interests involved, whether federal, provincial, corporate or private, will, respectively, be fully taken care of. Perhaps, for example, some arrangement may be made by which the federal governments shall provide the dams for navigation purposes, making available for each province its share of water-power under an arrangement by which the provinces would assume such financial and other responsibilities as were purely incident to the power assets.

BRITISH RECONSTRUCTION MEASURES.

Readjustment to Peace Basis of Industrial Plants in Hands of Experienced Committees.

An advisory council is planning as to the manner in which all stores, land and other property (excepting shipping and government factories) acquired for war purposes and no longer required, shall be dealt with—whether to be transferred to special government departments or sold to other parties. Control is to be exercised in such a way as to prevent speculation, unfair bargains or scrambling for and forcing up of prices of raw material.

A special committee of the British cabinet is dealing with post-war priority questions, and a standing council, composed of representatives of employes and workers in the various industries is also at work. For a long time past many subcommittees of the various engineering trades have been studying what articles not formerly made in the United Kingdom were likely to be in considerable demand in peace time. These committees have classified the articles showing whether they are capable of being made by (1) women, (2) men and women, (3) skilled men, and to what industries such new manufactures can be most suitably attached. One of these subcommittees deals expressly with electrical apparatus and it comprises the following men, all well known in British electrical industry: J. Taylor, chairman; L. B. Atkinson, representing the Cable Makers' Association; A. F. Berry, a transformer manufacturer; R. Dumas of the British Thomson-Houston Co.; D. N. Dunlop, director of the British Electrical and Allied Manufacturers' Association; B. Longbottom, an electric motor manufacturer; G. E. Pingree of the Western Electric Co., Ltd.; R. H. Schofield, representing a meter manufacturer; S. D. White of the General Electric Co., Ltd.; and H. Taylor, representing a big electrical plant manufacturer of Manchester. Another committee deals with scientific instruments. Special expert authorities have in hand the procuring of raw materials (aluminum, copper, lead, ferro-alloys, etc.), their study covering the possible requirements of all parts of the British Empire, of the Allies, of neutrals and of enemy countries.

Doctor Addison estimates that the British war stores for disposal will amount to $2,500,000,000. It is hoped that they may realize even more. In reply to the many questions that have been asked more or less anxiously regarding what the government is going to do with the national factories, the doctor said in the House of Commons on Nov. 12 that a number were entirely state-owned, others were partially state-owned and there were a large number of which the firms were the actual owners. There are 115 of this class. There are also 25 factories serviceable for storage purposes. After investigation it has been determined that in the case of certain factories it would be injudicious either to part with them or substantially alter them. As to factories which are considered redundant, offers for their utilization will be received. A great group has been reserved for storage purposes.

Two days after the signing of the armistice it was announced in Parliament that the ministry of munitions would be changed to a ministry of supply.

THIRTY PER CENT RATE INCREASE.

The New Orleans Railway & Light Co. has been authorized to increase its rates for electric and gas service 30%. Street-car fares have been increased from 5 to 6 cents.

War Emergency and Reconstruction Congress

Remarkable Convention of American Business Men Held at Atlantic City—Able Addresses and Practical, Far-Seeing Platform—Government Ownership of Railroads, Wires and Other Utilities Opposed

There were probably 5000 persons in the vast auditorium of Young's Pier at Atlantic City, N. J., Wednesday forenoon, Dec. 4, when President Harry A. Wheeler, of the Chamber of Commerce of the United States, called to order what was probably the most important gathering of American business men from all sections of the country called together by the Chamber to study and discuss the many reconstruction problems that pressed upon them, now that the great war had been brought to a triumphant end. There were present representatives of all the 350 war service committees of American industries; national councillors and presidents and secretaries of business organizations; members and additional representatives from every branch of our industrial and commercial life, meeting in 35 related groups. These groups were combined on the second day, following the first night's conference and action, into ten major groups, and from well informed and strong representatives of these went forth the final action on the resolutions and platform to the clearance committee for it to act upon and report to the final general session on Friday.

The machinery of the convention as outlined above, worked smoothly and intelligently until the results reached the now famous clearance committee. That valiant and stout-hearted band of patriots unloaded on it during Thursday afternoon and evening over 300 resolutions, carefully and studiously prepared, each aimed to help in the reconstruction program and correct perhaps some of the evils that had crept into our business life as we prepared for winning the war on such a titanic scale. That committee, however, was made of the stuff of heroes, loyal and true, and remained in session from 8 p. m. until 6 a. m. and was able—through its survivors—to present to the last general session, Friday forenoon, a platform of 35 resolutions and statements of principles.

All of these, with one exception, were unanimously endorsed with ringing cheers and applause. The one exception was on the resolution relating to the prompt return of the railroads to their stockholders, and two delegates out of some 3000 present favored a further trial of government ownership. This vote, as did all of the others where the question was included, showed the earnest opposition of the gathering to government ownership. It was strongly evident that the experience of the thousands of patriots who without recompense had served in the war industries committees at Washington and elsewhere in government work, were returning to the business duties of every-day life with strong and lasting convictions that government ownership was not a success. The snappy platform paragraph relating to the telegraph, telephone and cables epitomized this sentiment.

There follow the several resolutions of particular interest to the electrical and allied industries, just as they came from the clearance committee and were enthusiastically endorsed by the full convention.

Principal Resolutions and Platform Declarations Adopted.

Cancellation of War Contracts.—It is in the public interest that all war orders placed by any contracting agency of the Government and accepted in good faith, whether formally and regularly executed or not, should, upon cancellation by such contracting agency, be promptly and equitably adjusted and satisfied as if every formality had been observed, and when so adjusted the amount ascertained to be due by the Government should be promptly paid to the end that these funds may be utilized by the industries of the country to speed their transition from a war to a peace basis.

If it should be ascertained that legislation is necessary or desirable to accomplish this end, Congress should forthwith enact such legislation.

Officials dealing with questions of adjustment on account of war orders must necessarily be familiar with all the conditions affecting the order. It will greatly promote expedition and the interests of both the Government and private enterprise for the officials who made the contracts to remain in the Government service to participate in the readjustments.

Surplus Government Supplies.—Under date of Nov. 29, the Secretary of War issued a public statement: "To prevent too violent dislocation of industry from the standpoint of both employe and employer, accumulation by the War Department of either raw material or finished product will be distributed when and where liquidation of such supplies will least interfere with the return of industry to normal condition." Such action would seem to insure the stability of the industries affected which fully appreciate this liberal position.

Therefore the War Service Committees of American Industries hereby tender to the War Department their services for their respective industries for the purpose of advising with and assisting the War Department in the disposition of such materials.

Removal of Restrictions of Industry.—It is in the public interest that all war regulations of industry should be revoked and all war restrictions on industry should be removed as speedily as practicable, save such industries as are engaged in the production, preparation or distribution of foods, feeds, and fuel and such last-named group of industries should be freed from war regulations and restrictions as early as consistent with the welfare of this nation and of the Allies.

Industrial Co-operation.—The war has demonstrated that through industrial co-operation great economies may be achieved, waste eliminated, and efficiency increased. The nation should not forget, but rather should capitalize these lessons by adapting effective war practices to peace conditions through permitting reasonable co-operation between units of industry under appropriate Federal supervision. It is in the public interest that reasonable trade agreements should be entered into, but the failure of the Government to either clearly define the dividing line between those agreements which are, and those which are not, in unreasonable restraint of commerce, or to provide an agency to speak for it on application of those proposing to enter into such agreement in effect restricts wholesome co-operation and deprives both industry and the general public of its benefits. The conditions incident to the period of readjustment renders it imperative that all obstacles to reasonable co-operation be immediately removed through appropriate legislation.

Public Works.—The development of public works of every sort, as recommended by the President, should promptly be resumed, in order that opportunities of employment may be created for unskilled labor.

Inventories.—We urge that Congress should give careful consideration to the grave menace now facing all industry

due to the fact that both raw materials and finished goods are carried in full measure to meet the extraordinary requirements of the government and of the people, and that in large part the stocks have been acquired at abnormal cost and are therefore carried into inventories at inflated values, thereby showing apparent profits which have not been realized, and which probably will never be fully realized. These are largely bookkeeping or "paper" profits, and should not be used as a basis for taxation.

We therefore recommend that any tax law shall provide that during present conditions the taxpayer shall be allowed to make a deduction from his apparent profit by way

Harry A. Wheeler,

Vice-president of Union Trust Co., Chicago, and president of the Chamber of Commerce of the United States, who acted as the brilliant presiding officer of the greatest business men's convention yet held.

of a reserve for a subsequent shrinkage in the value of merchandise.

We believe that the interests of the Government can be protected against abuse of this privilege by the fixing of a maximum percentage of deduction to be allowed, and by the use of proper methods of inspection and appraisal.

Railroads.—The Congress of the United States should speedily enact legislation providing for the early return under Federal charters to their owners of all railroads now being operated by this Government under Federal regulations permitting the elimination of wasteful competition, the pooling of equipment, combinations or consolidations through ownership or otherwise in the operation of terminals, and such other practices as will tend to economies without destroying competition in service.

Means of Communication.—We are opposed to government ownership and operation of telegraphs, telephones, and cables.

Public Utilities.—Public utilities have faced difficult problems, which have been accentuated by conditions arising out of war. The development and efficiency of such a utility as local transportation has immediate importance for every community. It is recommended that the Chamber of Commerce of the United States should appoint a committee to investigate and study the question of local transportation as it relates to the control of rates and service, franchises, taxes, the attraction of capital into the business, and such other questions as the committee may find pertinent. Such a committee should report its recommendations to the Board of Directors of the National Chamber, and the Board should deal with them in accordance with the established procedure of the Chamber.

Water Powers.—Industrial activity is dependent upon the available supply of power. A bill which would affect the development of hydroelectric power upon waterways and lands which are subject to Federal jurisdiction is now before a committee of conference between the two Houses of Congress. It is important in the public interest that Federal legislation on this subject should be enacted without further delay. We accordingly urge that the conference committee arrive at an acceptable form of legislation in season for enactment at this session of Congress.

European Commission.—The business men of the United States, having devoted their energies and resources toward the winning of the war, regardless of sacrifices or burdens, in support of the principles for which this country fought, appreciate the necessity of continuance of unremitting effort in order that the world may be restored to normal conditions as quickly as possible and the blessings of peace brought to all peoples.

In the accomplishment of these results the highest efficiency of the great commercial and industrial powers of our own country and that of the Allied nations will be developed only through co-operative effort and common counsel.

In order, therefore, to contribute to the fullest toward the prompt solution of the problem presented, the Chamber of Commerce of the United States is requested to enlist the co-operation of national bodies devoted to the extension and promotion of American commerce and particularly foreign trade, in the appointment of a commission representative of American business, which shall proceed without delay to Europe and establish machinery for the following purposes:

(A) To study at first hand the reconstruction needs of European countries in conjunction with business men of these nations in order to advise the business men of the United States as to how they may be most helpful in meeting the necessities of Europe and caring for the interests of American industry and commerce.

(B) To be available to the peace delegates of the United States for any needed information which they may be able to present or for any other aid which may be given by the business men of the United States through the medium of such a commission.

The Chamber of Commerce of the United States also is requested to appoint members of the Commission to represent the business men of the United States at the forthcoming meeting of the Permanent Committees of the International Congress of Chambers of Commerce.

Markets for Foreign Trade.—We strongly urge upon our Government the vital necessity of encouraging and developing our foreign trade through all appropriate means possible, in order that the production of industry may afford employment to wage earners and prosperity to the nation.

Cost Accounting.—It is the sense of this convention that uniform cost accounting should be adopted by industries.

National Trade Associations.—The experiences of the war have clearly demonstrated the value of national trade organizations and their service to the country as well as to industry.

This conference heartily approves the plan of organizing each industry in the country in a representative national trade association and expresses the belief that every manufacturer, jobber and producer of raw materials should be a member of the national organization in his trade and cordially support it in its work.

Appreciation of Business Papers.—Whereas, through the enterprise of the Associated Business Papers, Inc., in publishing the *Reconstruction Conference Daily*, the many separate activities of the conference have been reported to the delegates, and

Whereas, this has brought about a degree of co-ordination and correlation which would otherwise have been difficult to attain, and

Whereas, the Associated Business Papers, Inc., and trade papers generally contributed generously of their assistance in the preparations for the conference, and through the publicity and advice freely given their readers, played a highly important part in drawing together this record-breaking attendance of the leaders of American business; therefore,

Be it resolved that the Reconstruction Conference hereby tenders its thanks and appreciation of the aid so effectively given by the business press of the country.

The Clearance Committee.

The Clearance Committee must not remain unknown to fame, for its was the most intricate and serious work of the day, and its duties were performed with a wisdom and skill never excelled, if ever equalled. The names of the committee members and the major groups they represented are as follows:

Judge Joseph H. Defrees, Chicago, chairman; E. W. Rice, Jr., New York, heat, light and power; Lewis E. Pierson, New York, food; John W. O'Leary, Chicago, iron and steel; Eugene Meyer, Jr., New York, metals aside from iron and steel; Charles Cheney, Manchester, Conn., textiles; John H. Kirby, Houston, Texas, wood; Dr. William H. Nichols, New York, chemicals; August H. Vogel, Milwaukee, leather; N. E. Carson, Riverton, Va., earthen products; Chas. A. Stone, New York, industrial professions; R. G. Rhett, Charleston, S. C., Chas. Nagel, St. Louis, C. S. Brantingham, Rockford, Ill., members at large.

Summary of Other Important Resolutions.

In addition to the above resolutions, the Congress approved several others relating to our foreign trade relations. In these, the cultivation of relations with the various countries of South America and the supplying of all foreign countries with sufficient food and raw materials for their immediate needs was urged, the Government was heartily commended for its stand against the threatened confiscation of American property in Mexico, and the providing of opportunities for young men to obtain an education in the practices of overseas commerce and finance and in the practical use of foreign languages was recommended.

Another important resolution heartily endorsed in letter and spirit the principles of the industrial creed so clearly and forcibly stated at one of the sessions by John D. Rockefeller, Jr. Other resolutions were: That certain so-called pivotal industries which developed during the war be encouraged and provided for; that the local chambers of commerce relieve, as far as they are able, the temporary condition of unemployment which may exist in some places on account of the dislocation of labor during the period of the war; and that the construction of a great merchant marine be continued and amplified and that its operation under American control be kept safe by suitable legislation.

Extracts from the Principal Addresses.

Where there were so many distinguished speakers it is impossible to do justice to all they said in the limits of these columns. But below we give a few brief extracts from several of the most notable addresses before the general sessions:

By Charles M. Schwab on "Autocracy in Labor and in Capital Is Dead."

"This great war has taught us that we must concede things to labor even though some unjust demands may be made.

"But this is eternally true: Labor in dealing with its employers should be representative of the men in that shop and that trade. I have no patience with walking delegates from Kamchatka who try to dictate to me working conditions in Bethlehem.

"This is the day of democracies, the day of tolerations, of adjustment and readjustment. We manufacturers must be content for awhile with little profits or with no profits. We must take care of our workers and make them contented. In my private business there are 170,000 employes and we have a payroll of $25,000,000 a month.

"The smokestacks at Bethlehem and the other plants are the only monuments I have erected, the only ones I want erected to my memory.

"After all is said, when the history of these days shall be written, it will not be the masters of capital, the shipbuilders, the airplane manufacturers, whose names will live. The immortal, golden names will be those boys of ours who rendered the supreme sacrifice of American devotion on the fields of Flanders and France.

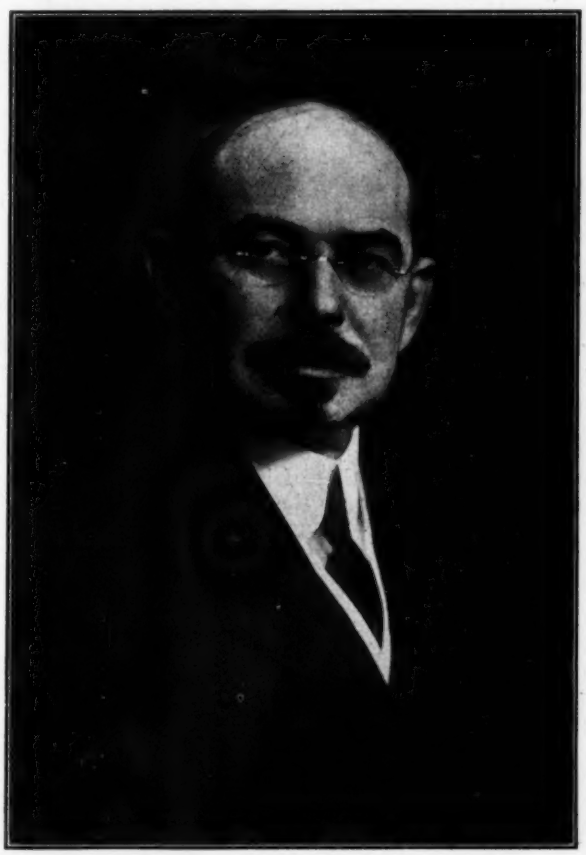
"Mr. Secretary of Commerce, I want you to take back to the President and the Cabinet the message that America's shipping must be maintained and that American business must have fair treatment, with confidence that generosity and justice will govern the relations between capital and labor."

By Secretary of Commerce Redfield:

"We stand in a new relation to foreign trade. The nation has a new vision as a result of its unprecedented sacrifices, and we may have others ahead of us as a result of our new and close relations with Allied nations.

"We must supply the world with much equipment and raw material, and that is going to take ships to carry them. We have got to keep a large army—large as we call armies—on the other side for some time to come, and they will have to be fed and furnished with supplies.

"We do not know what is behind the Russian veil. A job may need to be done there that we dare not leave undone. We hope not. But we must have a considerable army abroad; not half our present one,



E. W. Rice, Jr.,

President of the General Electric Co., who represented the major group of heat, light and power industries in the Clearance Committee that worked all night to formulate the platform of the Reconstruction Congress.

but still a considerable force, and they must be fed and supplied.

"Every ship the world has and can get has all of its carrying capacities taken for the next two years to come. Many of our ships will be used for our growing and developing trade with South America, because a number of our vessels are of a type which it is not economical to send abroad. We should, therefore, have no fear on that score.

"There is no doubt, humanly speaking, that prosperity lies ahead for America, but there is yet an unsolved doubt as to what use America will make of her prosperity.

"If you can leave to your sons as they go about the earth the knowledge that America rose to a height of marvelous power, financial, military, political, industrial and economical, and she used that power to her own good always and also always for the good of the world, then your sons can walk as no German can walk, can travel the whole round orb of the globe, among friends knit to one another with bonds of esteem and affection which cannot be broken."

By John D. Rockefeller, Jr.:

"One of the most useful lessons which the struggle has taught is the value of co-operation.

"Who are the parties to industry? They are four in number—capital, management, labor and community. Capital is represented by the stockholders and is usually regarded as embracing management. Management is, however, an entirely separate and distinct party to industry—it consists of the executive officers, who are the administrators of the industry and who bring to it technical skill and managerial experience.

"Labor is represented by the employes, but its contribution, unlike that of capital, is not detachable from the one who makes it, for it is his physical effort, his strength, his life. Here the list usually ends, for the fourth party, namely, the community, whose interest is vital and in the last analysis controlling, is too often ignored.

"The community's right to representation in the control of industry and in the shaping of industrial policies is similar to that of labor. But for the community's contribution, in the maintenance of law and order, of agencies of transportation and communication, of systems of money and credit and of other services, all involving continuous outlays, the operation of capital, management and labor would be enormously hampered, if not rendered well nigh impossible.

"Furthermore, the community is the consumer of the product of industry, and the money which it pays for the product provides the wages, salaries and profits that are distributed among the other parties.

Mark L. Requa, general director of the Oil Division of the United States Fuel Administration, advised the abrogation of the Sherman Law and the establishment of a Federal Board of Trade. On the former subject he said:

"It needs only a review of the activities of Government during the past year and a half to demonstrate how utterly inadequate existing laws have been in meeting even the simplest problems. Industry might not combine our railways, but the Government was forced to combine them to give reasonable and adequate service.

"Industry might not sit in conference and discuss trades relations, practices and prices, lest it infringe upon the Sherman Law, yet the Government promptly demanded co-operative action in order that industry might efficiently discharge its function.

"Government and industry have worked hand in hand and pointed the way to future activities, which if realized can but be most highly beneficial to all."

Alba B. Johnson, president of the Baldwin Locomotive Works, called the attention of the business men to the necessity for the closest possible scrutiny of the $6,000,000,000 tax measure which is now pending in Congress. He spoke of the desirability of apportioning taxation with reference to the encouragement of business actvities and of limiting the amount to be raised by the proposed revenue bill for 1918 now pending in Congress to a maximum of $4,000,000,000 or to such sum as Congress judges to be necessary, this being a proposition so manifest to business men as to require no further discussion.

"I am urging this," Mr. Johnson said, "for your approval, not as a selfish matter, but as one involving all our interests and freighted in fact, with no inconsiderable public interest."

O. K. Davis, of New York, secretary of the National Foreign Trade Council, in the absence of the author, read the address of President J. A. Farrell of the United States Steel Corporation, and it was received with intense approval.

In the course of his powerful address, Paul M. Warburg, former member of the Federal Reserve Board, said:

"As I look through the telescope into the period following that of transition, I see a United States to which the world at large will be heavily indebted, and to which annually hundreds of millions of dollars will be due as interest on loans extended, in addition to the hundreds of millions due in payment of the raw materials we shall be able to spare for other countries. I see an industrially highly developed country which, with the exception of a limited number of articles, will be capable of producing most of the necessaries of life for the consumption of its own people.

"I perceive, therefore, a country amply protected by a vast, annual international credit balance, a country which by keeping some portion of its foreign security holdings in the form of reasonably short obligations, should be able to protect itself against any serious encroachment upon this creditor position; a country owning a huge gold stock; a country, in short, which need not give itself any great concern with regard to the task of maintaining the parity of the dollar exchange all over the world.

"I much misread the future if it does not have in store for New York the position of a world exchange center, vying with London as a free gold and discount market. As I see it, our future economic position will be of such strength that it will be difficult for many countries to keep their exchanges at par with us.

"The next year or two must bring forth legislation which ought to be for the railroads what the Federal Reserve Act has been for the banks. To find the proper formula will be a national contribution of the highest order.

"The reconstruction period is pregnant with the seeds of good or evil; what it brings forth will depend upon the care and devotion that the country gives to its problems. It is a period, as its name indicates, for constructive thought, not for destructive criticism."

Group Meetings.

In the related-group meetings, 35 in number, were included all the principal American industries. These groups discussed their various problems and reported by speech and resolution to the major group meeting held later, the major groups comprising a total of ten.

Of special interest to the electrical industry was the

Related Group No. 5, Public Utilities and Electric Railroads. Henry L. Doherty was chairman and Chas. W. Price secretary, and the speakers were Philip H. Gadsden, of the Charleston Consolidated Railway & Light Co., Charleston, S. C.; J. B. McCall, president Philadelphia Electric Co., Philadelphia; and W. H. Gartley, United Gas Improvement Co., Philadelphia. It was decided to recommend that the situation of the electric railways in respect to rates, franchises and investments should be studied and reported on by the National Chamber of Commerce. In Mr. McCall's address he stated that nearly 800 of his employes, who had gone to war, would find instant employment with his company on their return.

On motion of J. W. Lieb, of the New York Edison Co., a resolution was unanimously adopted favoring similar action on the part of all industrial corporations.

The importance of favorable water-power legislation by Congress was discussed by Chairman Doherty, Calvert Townley, and J. W. Lieb.

This group meeting was attended by about 60 leading representatives of the electric lighting, electric railway and gas interests of the United States, and general encouragement for the future, and renewed activity in all public utility fields were predicted.

In the meeting of Major Group No. 2, of which John W. Lieb was chairman and F. M. Feiker was secretary, addresses were delivered by Mr. Calloway, of Coal Division of the Fuel Administration, and by Mark Requa, of the Oil Division of the Fuel Administration. Mr. Requa offered as a solution of our national problems, first, a national budget; second, that members of the cabinet sit in the House of Representatives and be answerable to the House for their actions; and third, that a United States board of trade with strong powers be established as a method of proper government supervision of business.

W. W. Nichols spoke in favor of Federal legislation to develop water power. He quoted from a French report which urged the "speedy utilization of hydraulic power as constituting the best means of stimulating, without ruinous importations of coal, the development of public utilities and of great industries necessary not only for the security but also for the economic life of France."

From the report of the British Ministry of Reconstruction, he read the following:

"In the United States the amount of power used per worker is 56% more than in the United Kingdom; if we eliminate workers in trades where the use of power is limited, or even impossible, we shall probably find that in the United States the use of power, where it *can* be used, is nearly double what it is here. On the other hand, not only are the standard rates of wages higher in the United States, but living conditions are better. There is little doubt that in the United States the average purchasing power of the individual is above what it is in this country, and that this is largely due to the more extensive use of power which increases the individual's earning capacity. The best cure for low wages is more motive power. Or, from the manufacturer's point of view, the only offset against the increasing cost of labor is the more extensive use of motive power. Thus, the solution of the workman's problem, and also that of his employer, is the same, viz., the greatest possible use of power. Hence, the growing importance of having available and adequate and cheap supply of power produced with the greatest economy of fuel."

A resolution was adopted urging upon Congress the imperative necessity of an agreement of the Conference Committee of the two Houses, which "will result in the passage of a joint water-power bill to protect the public interest, and promote the early utilization of this long neglected national resource."

Another resolution was adopted by this Major Group after some debate favoring highway improvement to be carried on by the states and counties and not by Government appropriation and taxation. This was the most interesting fight of any of the group meetings, and resulted in a victory for those opposed to Government control of this work by the overwhelming majority vote of 110 to 2.

The War Service Committee of the electrical jobbing industry met and discussed matters of interest, chiefly relating to the National convention at Cleveland the coming week. Among those present were Franklin Overbagh, F. M. Bernardin, N. G. Harvey, E. Donald Tolles. Other electrical men in attendance, other than those heretofore mentioned, were C. E. Corrigan, of Pittsburgh; Chas. L. Edgar, Boston; E. Dwight Johnston, Connersville, Ind.; J. Brackenridge, New York; Chas. A. Terry, New York; J. R. Lovejoy, Schenectady; L. A. Osborne, Pittsburgh.

The Associated Business Papers, Inc., of New York, issued a daily paper giving a report of all conference news of the previous day. This was a very popular feature of the conference, and many compliments were bestowed on the officers and editors of the Business Papers for their enterprise and assistance.

BRITISH RAILWAY MANAGER'S VIEWS ON SUPER-POWER STATION CONTROL.

Location of Large Power Stations in Coal Regions or Industrial Centers Important Question to Decide.

Sir John Aspinall, president of the Institution of Civil Engineers, and manager of one of the great English railroads, referred in a recent address in London to many points regarding improvements in railroad working. Touching upon the subject of electrification, he said he had taken a somewhat active part in certain phases of the government electric power supply inquiry. This had brought him into contact with many of those interested in the supply of cheap current for industrial use and had led to the conclusion that there was a very strong desire on the part of all who were likely to be large consumers to see that the views expressed by the electric power supply committee as to the creation of suitable super-power stations in well-selected districts were carried out, though there were various objectors to the detail of the methods proposed. The leading idea was, however, one of co-operation in any well-devised scheme and a recognition of the prospective advantages of at last having some central authority, possessing knowledge and power, to deal with the great electrical question of power supply. Sir John said: "One of the most serious questions which any new body of electricity commissioners will have to decide is whether it is better to put your generating station in the midst of the coal fields or in the midst of the industries which you desire to supply with power. Is it cheaper to convey the coal for generation by a long line of railway or to convey your current by a long line of copper? These will be nice questions involving the balancing of all-round costs and will vary much in different districts." Sir John says that the railroad demand for current will be far in excess of that for any other industry and that it is open to doubt whether it is wise to divorce the control of generating stations for railway supplies from the management of those who are responsible for the operation of the traffic. He recognizes that the super-power station is a modern necessity but the question of control requires much thought.

Editorial Comment

The Reconstruction Congress

A BRIGHT and imperishable page was added to America's industrial history at Atlantic City last week. Over four thousand earnest, strong, patriotic citizens met to counsel and to learn in a Reconstruction Congress, held under the intelligent auspices of the Chamber of Commerce of the United States of America. It was a gathering which in tone and personnel made one proud of his country and his countrymen, and confident of a wonderful, though uncharted commercial future.

These were business men, representative of material things, yet elevated by the spirit of past sacrifice, of freely-given toil and means to the glorious struggle that right must prevail over might. They had done their full, tremendous share in winning the war; now this giant strength was assembled to organize for the future welfare of our nation—*the* nation of all honest nations. It was met to take serious stocks of the unprecedented present and plan for the unknown days and years to come.

From the opening address on Wednesday by the able president, Mr. Harry A. Wheeler, to the concluding words on Friday by that eminent and truly prophetic financier, Mr. Paul M. Warburg, there had been a constant and unbroken sentiment of loyalty to the country, and optimistic expression that we were entering upon a finer and broader life for all.

President Wheeler in his uplifting opening remarks said:

> "American business has given no consideration to its sacrifices; it has made them freely, and, when asked, has often doubled the sacrifice that was originally proposed, and through its patriotism and through its sacrifice and through its disregard of selfish interests and its willingness to give of itself to the uttermost, we have been successful in bringing about a conclusion of the war that could not have been reached but for this patriotic fervor of American business at home.
>
> "Well, that page has been written and the pages turned over and a new white page of the book of life in America is for the writing of the message of this week. One task completed, another task beginning. My feeling is that American business will write, upon this new page, a record as unselfish, as considerate and as glorious as the records on the page that has just been turned."

We ask no pardon for giving liberal space on other pages to a record of this historic gathering. The greatest as well as the most modest of our progressive business men were present, and all contributed as they could to the discussions and conclusions that ever pointed to a higher national heritage.

As an earnest exponent of a vast and most progressive industry, the ELECTRICAL REVIEW would express its deep appreciation of the discerning vision and wise judgment of the authors of this movement, and of their uniquely successful management. A program of speakers that included among others Charles M. Schwab, James A. Farrell, John D. Rockefeller, Jr., Paul M. Warburg, Secretary Redfield, and President Wheeler, could not fail to give inspiration and enlightening suggestions to every one. And to the worn and weary members of the Clearance Committee, whose work from 2 p. m. until 6 a. m. brought forth some thirty-five practical and illuminating resolutions and platform statements—comprehensively reduced from upwards of three hundred—should be accorded grateful thanks. Their labors were appreciated by unanimous indorsement and stirring enthusiasm with much applause.

This republic of ours is better—far, far better, and stronger and safer—for these three days of counsel and discussion. And this Reconstruction Congress will in its widening and elevating influence ever possess an important page in the history of the proud business life of the United States.

Scientific Operation of Boiler and Turbine Rooms

THE SUCCESS in power plant operation rests upon accurate and sufficiently complete operating data, available in accessible form. Moreover, it is necessary that these data be studied properly and that action follow accordingly. Eternal vigilance is the keynote of efficiency in turbine room as well as boiler room. But vigilance without sufficiently complete and accurate records correctly interpreted can bring economy only by chance.

Elsewhere in this issue will be found the final installment of Messrs. Hirshfeld and Karr's article on the "Economic Operation of Steam Turboelectric Stations." This final article deals with the economic operation of apparatus, based upon fuel economy.

What has been said already as to the operation of turbines so as to permit them to operate at their most efficient loading the most part of the time applies also to the operation of boilers and boiler-room equipment. With the boilers, however, the matter is somewhat different than with turbines, because a boiler, although not in active service, is kept hot with fire banked ready for starting up on short notice. Although it is cheaper to keep the fire banked, it not being practical to allow it to go out, banking represents a coal consumption of very real magnitude. However, the engineer who knows the efficiency of his units at all loads and weighs his coal so that he knows how much is required for banking for any definite period, is readily able to determine whether it is most economical to

bank a number of boilers and operate others at certain loads or keep a larger number of units in service at lower individual efficiency. This feature of boiler-room operation has been worked out in such manner that all can appreciate the significance of systematic boiler-room operation.

The choice or operation of auxiliaries has often in the past been considered as a relatively unimportant if not trivial matter. The main units were considered as the all-important elements in affecting plant economy, and these received none too much attention. However, in this article by Messrs. Hirshfeld and Karr the subject of auxiliaries and their influence upon heat losses and conservation are covered in a way that should once and for all banish the idea that the operation of auxiliaries and ancillary apparatus is of little account.

As much as possible of the auxiliary power should be so obtained that the resultant exhaust steam can be absorbed by the feed water. The remainder of the necessary auxiliary power should be obtained in electrical form from the most efficient units available. When these things are done, maximum thermal economy will obtain. The first requirement, then, for efficient operation of auxiliaries is that the proper type and form of unit, steam, electric or both be chosen; secondly, that they be correctly operated so as to conform to the conditions existing. It is these matters that are dealt with at length in this article on the "Economic Operation of Steam Turboelectric Stations." No broad statements can be made as to the choice of power to be supplied to auxiliaries, as each installation must be considered on its own merits. Certain fundamentals can be laid down, nevertheless, and a study of these as laid down in the present issue will be found instructive and well worth while.

That the proper operation of auxiliaries is of tremendous importance can be realized when it is pointed out that the total amount of power used for auxiliaries often amounts to 10 per cent of that sent out. The thermal savings brought about by using larger main turbines or the practice of some economy in the boiler room may be quickly counteracted by careless or wasteful operation of the auxiliaries, therefore. In fact, the condition is analogous to saving at the spigot and wasting at the bung.

On page 941 of this issue will also be found some timely and pertinent remarks by Joseph Harrington, administrative engineer, United States Fuel Administration, on the importance of station records, and with recommendations for making and keeping them.

The modern efficient plant, whether central station or industrial or isolated plant, as we have pointed out before, if to continue operation at its maximum efficiency, must be undergoing what is virtually an hourly, daily, weekly or monthly test as a matter of routine. The tendency in power plant design is more and more to install testing facilities as a permanent and integral part of the station equipment, so as to readily permit the testing and supervision of individual units without trouble or interruption of service. This is as it should be, since plant testing and responsibility for best results must be continual and not sporadic if a plant is to maintain a high standard and give continually the best results.

Public utilities are coming more and more to be looked upon as public trusts. Inefficiency and preventable waste, laxity and ignorance are no longer legitimate excuses for increased rates. The power plant that does not know what it is accomplishing or how it accomplishes it maintains efficiency on a hit or miss basis at best. Modern power plant management is a science and is based upon scientific methods. And these methods are based, guided and modified by the records of operation.

Local Utility Financing

ON SEVERAL occasions the advantages and possibilities of financing utilities by local subscription have been discussed in these columns. A comparatively few central-station companies have offered stock from time to time to their customers and residents in the territory served by them. In some of these instances regular campaigns have been carried on, very similar to appliances campaigns; in others less energetic or widespread methods have been employed.

During the last year or two, due to the condition of the money market resulting from the war, the flotation of Liberty Loans, and so forth, local subscription was found to be not only quick of results but also a less expensive way of raising capital. Customers requiring increased amounts of power and new customers wanting to go over to central-station service have found it not only advantageous to become stockholders of the local central-station company, but sometimes the only way to have their needs met.

In his annual report, which really constitutes a financial history of America's part in the World War, Secretary of the Treasury McAdoo, in reviewing financial methods during the war, pointed out that "the war savings movement had resulted not only in gathering $834,000,000 into the treasury for war purposes, but it had helped to teach the American people thrift and economy. . . . This war-time experiment has been so successful that it is hoped war-savings certificates will become a continuing feature of the nation's financing even after the restoration of peace."

A utility that raises its capital among those it serves and those dwelling in the territory it covers is following a policy that tends to strengthen the bonds between the community and the utility, encourage friendliness and co-operation, allay discord and the troubles that come from civic friction and political propaganda. A utility certificate similar to a war savings certificate, small denominations payable on easy terms, is worthy of thought by the central station requiring money and local support.

Week's Events

Manufacturers of Power Plant Specialties Hold Important Conference—Illuminating Engineers Meet—Other News

IMPORTANT CONFERENCE OF POWER PLANT APPARATUS MANUFACTURERS.

Organization Formed to Further Manufacturers' Interests and Make Permanent Fuel Saving and Plant Improvement.

On Dec. 6 a meeting took place at the City Club, Chicago, that promises to effect as important and radical improvements in the power plant situation as has the work of the United States Fuel Administration. On this date was held the first International Power Economy Conference, the purpose of which was to bring together and unify the manufacturers of power plant equipment and auxiliary apparatus, and place them in a truly representative body. It was intended that at this conference the nucleus of an association of manufacturers of power plant apparatus should be formed, whose aims should be to co-operate for mutual advantage, standardization of specifications and guarantees, improved conditions of doing business, to forward the interests of the power-plant owners and operators, to carry on a campaign of education and enlightenment as to fuel economy and plant betterment, and co-operate with the Fuel Administration and Bureau of Mines so as to lay at their disposal their wide knowledge and experience and powerful engineering talent.

The meeting was called to order by C. A. Tupper, a consulting engineer, and president of the International Trade Press, in the chair. Mr. Tupper outlined the reasons for bringing together the manufacturers of power-plant apparatus at this time, emphasizing the need for immediately carrying on the good work so ably commenced by the Fuel Administration, if a retrocession in the fuel-saving and plant betterment movements is to be prevented, now that the insatiate demands of war have ceased. The Fuel Administration was formed as a war measure primarily, and even if the Bureau of Mines takes over its work, the best interests of the movement require staunch support and co-operation by the manufacturers of power-plant equipment.

A message was received from David Moffatt Myers, addressed to the meeting, pointing out the importance of the work it was taking up and pointing out that nothing better could be done to bring about the aims of the conference than to encourage among its members the spirit of service. The importance of selling apparatus only where requirements indicated, of educating the users in its use, and of furnishing "service" as well as equipment were mentioned. The members associated can prove of immense benefit to the country, to the power plant operators and to themselves.

Joseph Harrington, administrative engineer, Fuel Administration, representing also David Moffatt Myers of the Fuel Administration, discussed the future of the work inaugurated by that administration, and how the statistical work could be carried on effectively by the Geological Survey, and the engineering and fuel economy work by the Bureau of Mines. He reviewed the many difficulties that had had to be overcome under such adverse conditions, and emphasized the great loss that would occur if the movement now barely commencing should be stopped. Many operators are only awakening to the shortcomings of their plants and the advantages that follow improvements. If these plants are not encouraged and helped, many will eventually revert to their old wasteful ways.

A number of informal talks were delivered during the morning, these including one by Joseph W. Hays, of the Joseph W. Hays Corporation, on the "Use of Boiler Room Instruments"; "Combustion Engineering," by Joseph Harrington; "Mechanical Draft and Mechanical Stoking," by F. H. C. Coppus, of the Coppus Engineering & Equipment Co.; "Making the Boiler Room Automatic," by Ivor L. Kentish-Rankin, of the ELECTRICAL REVIEW; "Relation of Soot to Power Plant Economy," by E. P. Stroup, of the Diamond Power Specialty Co., and "Reduction of Radiation Losses," by R. J. Stewart, of H. W. Johns-Manville Co.

At the afternoon session there were talks on "Coal Washing" and "Pulverized Fuel," by B. J. Roberts, of the Deister Concentrator Co.; "Engine Room Economy," by B. W. Thurtell, of the Skinner Engine Co.; "Increasing Efficiency of Steam Turbine Installations," by Myron M. Fowler, of the General Electric Co.; "Choice of Prime Movers" and the "Future of the Steam Engine and the Diesel Engine," by H. W. Dow and B. V. E. Nordberg, of the Nordberg Manufacturing Co.; "Use of Stokers," by Frank M. Smith, of the Under-Feed Stoker Co. of America, and W. L. Schultz, of the James A. Brady Foundry Co., and on "Steam Traps," by George B. Burke, of the Sarco Co., Inc. Those taking part in the proceedings included Zell F. Harshton, of the H. W. Johns-Manville Co.; F. A. Moreland, of the Vulcan Fuel Economy Co.; Arthur W. Knight, of the Celite Products Co.; Francis W. Carret, of the Foxboro Co., Inc.; C. J. Carlsen, of the Commonwealth Edison Co.; V. B. Nickerson, of Greene, Tweed & Co.; J: J. Connelly, of S. F. Bowser & Co., Inc.; G. J. Zanke, of the American Engineering Co.; R. C. Acers, of the Engineer Co., and George B. Burke, of the Sarco Co., Inc.; while among delegates registered were Lawrence L. Shailer, of the Ehret Magnesia Manufacturing Co.; Robert E. Hall, of the Goulds Manufacturing Co.; Albert Goetz, of the Jointless Fire Brick Co.; R. C. Warner and T. A. Peebles, of the Hagan Corporation; E. D. West, of Fairbanks, Morse & Co.; A. R. Maujer, of "Power"; R. E. Soules, of the Brown Instrument Co.; Clem C. Ford, of the Jeffrey Manufacturing Co.; O. E. Anderson, of the Wheeler Condenser & Engineering Co.; F. L. Webster, of the Allis-Chalmers Manufacturing Co.; H. C. Shields, of the Fuller Engineering Co.; W. T. Dean, of the General Combustion Co.; W. O. Batchelder, of the General Electric Co.; M. P. Vore, Jr., of the Republic Flow Meters Co.;

S. Wolff, of the De Laval Steam Turbine Co.; C. J. Mettler, of the Deister Concentrator Co.; H. Ehrlich, of the ELECTRICAL REVIEW; L. A. Sisley and H. W. Walker, of *Engineering World*; A. W. Patterson, of the Engineer Co.; B. W. Thurtell, of the Bayer Steam Soot Blower Co.; J. J. Kolar, of *Cement, Mill and Quarry*, and Oscar E. Thaleg, of the Worthington Pump & Machinery Corporation, and others.

All present indulged in an informal discussion and much that was of value in an operating way was brought out.

The following resolutions were drawn up by a committee composed of Joseph W. Hays, of the Joseph W. Hays Corporation; F. A. Moreland, of the Vulcan Fuel Economy Co., and C. E. Brainerd, of the Brainerd-Fairchild Engineering Co.:

"Whereas, it has been demonstrated and proved by competent engineers that one quarter of the fuel mined in the United States is uselessly wasted by the consumer, said waste amounting to approximately 150,000,000 tons of coal per annum, representing in money value about $1,000,000,000, and

"Whereas, such waste is an economic crime, in that it increases the cost of fuel which in its turn increases the already high cost of living through the increase in the cost of power production, and

"Whereas, our limited fuel resources should be conserved as far as possible for uses of posterity, and

"Whereas, the National Fuel Administration has already performed a service of inestimable value to the country through its effective work in educating and otherwise assisting consumers of fuel, and

"Whereas, this effective work of the National Fuel Administration is, in our estimation a mere beginning of the good work that can be accomplished, and

"Whereas, if some provision is not made to carry on the work so signally inaugurated by the National Fuel Administration, we believe that the good already done will soon be undone, and that fuel consumers will revert to their wasteful practices of the pre-war period, and

"Whereas, the Bureau of Mines of the Department of the Interior is admirably equipped and otherwise qualified to take over and carry on the work of the National Fuel Administration, Therefore,

"Be it resolved: That we, the International Power Economy Conference, call upon the Congress of the United States to enact such legislation as may be necessary to continue the work of fuel conservation so successfully begun by Dr. Garfield and his able associates.

"And we recommend that the work of the National Fuel Administration be taken over and continued by the Bureau of Mines, and that the said Bureau of Mines be given full authority by appropriate legislation to enforce all the recommendations that it may see fit to make concerning the conservation of all fuels at their sources of production, in transportation and storage, and in their final uses, whether for domestic purposes, for the production of light, heat and power, or for any other use whatsoever, and be it

"Resolved, that a copy of these resolutions be sent to the following: The President of the United States; Members of the Congress of the United States; the National Fuel Administration; the Bureau of Mines; the National Press Associations; the Trade Press; and all Engineering Associations."

It was further resolved, unanimously, that the executive committee be authorized and instructed to communicate with the Director of the U. S. Bureau of Mines, advising him of this organization of power-plant equipment manufacturers, and offering the assistance and co-operation of the association in his work of fuel conservation.

Arrangements have been made for a permanent organization. On motion of Joseph Harrington, in behalf of the organization committee, Chairman C. A. Tupper was authorized to appoint members of an executive committee to plan and supervise the organization of future conferences and also members of such other committees as may be found necessary to carry on the work outlined by or for such conferences. A detailed report of this, the first International Power Economy Conference, will be given in the next issue of the ELECTRICAL REVIEW.

ELECTRICAL EXPORTS FOR SEPTEMBER ABOVE AVERAGE.

Increase in Value Over September of Last Year is Above 30 Per Cent.

A good showing is made in the electrical export figures for the month of last September, as disclosed in the summary of the foreign commerce of the United States issued by the Bureau of Foreign and Domestic Commerce, Washington, D. C. As compared with the corresponding month of last year, the September electrical total shows an increase of over 30%. This total is also above the average of the first nine months of the present calendar year. For this period in 1918 the electrical total is $43,756,901, as compared with $39,977,642 for the corresponding nine months of 1917, and $27,027,623 for the similar period of 1916.

The following table gives the detailed comparative figures for September, 1918, and September, 1917:

Articles.	September 1918	September 1917
Batteries	$ 250,037	$ 187,665
Carbons	125,956	96,297
Dynamos or generators	269,276	106,784
Fans	26,396	52,808
Heating and cooking apparatus	48,552	39,927
Insulated wire and cables	548,640	774,326
Interior wiring supplies, including fixtures	88,139	64,713
Lamps—		
Arc	4,141	1,193
Carbon filament	6,369	6,948
Metal filament	282,518	205,793
Magnetos, spark plugs, etc	206,160	239,724
Meters and measuring instruments	100,301	111,906
Motors	589,905	468,867
Rheostats and controllers	12,993	4,882
Switches and accessories	162,049	166,299
Telegraph apparatus, including wireless	42,289	17,707
Telephones	228,961	106,758
Transformers	392,026	88,660
All other	1,761,369	1,200,962
Total	$5,146,077	$3,942,219

ELECTRICITY TO PLAY PROMINENT PART IN INTENSIVE MINING.

Coal Mining Institute of America Considers Power and Other Important Topics.

Development of intensive methods of coal mining was one of the principal topics for discussion at the annual meeting of the Coal Mining Institute of America held at Pittsburgh, Pa., on Dec. 5 and 6. Implied in this is concentration of mining operations, greater use of machinery for mining, loading and haulage, and more effective use of capital invested in the workings and equipment. This matter was presented by E. N. Zern, editor of the Mining Catalog, who read a paper on "Underground Coal-Loading Machinery"; Mr. Zern was elected president of the Institute for the ensuing year.

Elimination of power losses in mining operations was the subject of an address by Graham Bright, electrical engineer, Westinghouse Electric & Manufacturing Co. Methods to be used in the elimination of power losses may be divided into two classes, one of which will produce immediate results. Under this class the following are necessary: Regularity of inspection and repairs to power-plant equipment; instructions to firemen, engineers and electricians; scheduling the use of power to improve the load-factor; improving the transmission and return-circuit condi-

tion, and changing time of starting day shift. The second class, by reason of equipment and changes involved, may require several months before results are noticeable. Under this class the following are necessary: Installation of new equipment, changing over to electric operation, changing over to central-station power, providing spare equipment, providing spare parts.

"Use and Abuse of Headlights on Mine Locomotives" was discussed by M. K. Mackall, of Syracuse, N. Y. He described the three most common types of arc and incandescent headlights and showed that a proper understanding and application of the characteristics of each type would overcome most headlight troubles. Another paper that aroused much interest was that presented by K. C. Barth, of Chicago, and dealing with the preservative treatment of mine timbers.

ELECTRICAL JOBBERS HOLD IMPORTANT MEETING.

Many and Varied Topics Discussed by Large Gathering at Cleveland, Ohio.

One of the most largely attended and live meetings ever held by the Electrical Supply Jobbers' Association was held at the Hotel Statler, Cleveland, Ohio, Dec. 9, 10 and 11. This meeting had been scheduled to take place Oct. 21 to 23, but had to be postponed on account of the widespread epidemic of influenza and pneumonia.

The program arranged for the original meeting was carried out to a considerable extent, with the addition of many vital problems of the hour, problems of readjustment and reconstruction that have come about so suddenly on account of the rather unexpected cessation of the World War. Among the problems that received much attention and deliberation were those concerned with the value of stocks, methods of readjusting business to the time, safeguarding investments and the question of advertising. A detailed report of this meeting will be given in the next issue of the ELECTRICAL REVIEW.

ENGINEERS NEEDED FOR RECLAMATION AND RECONSTRUCTION WORK.

Work of Division of Engineering in Supplying Technical Help to Be Continued.

The attention of engineers and technical men is called to the service of the Division of Engineering, 29 South La Salle street, Chicago, for the purpose of giving them free assistance in securing employment. The work of the Division of Engineering is already known to thousands of technical men who registered during the war. Many of these men were placed in positions that made them very useful in the projecting of the war. Others were placed, to their advantage, with important concerns, while many others were retained for development and research work with the Government.

It is gratifying to know that this Division will be continued for reclamation and reconstruction work. The service which it offers, the first of its kind in the history of the United States, is free of charge for anyone who desires it. At the present time there are a number of positions open for engineering work of all kinds in practically every part of the country. Technical men should pass this word along in order that they may help each other and help the men returning from the front.

For registration blanks write A. H. Krom, Director of Engineering, 29 South La Salle street, Chicago, Ill.

TELEPHONE WAR OPERATIONS DESCRIBED TO NEW YORK JOVIANS.

Illustrated Lecture by H. J. Carroll Feature of Monthly Meeting.

The New York Jovian League held its monthly luncheon at the Hotel McAlpin, Nov. 26. The principal feature of this occasion was an illustrated lecture by Henry J. Carroll of the New York Telephone Co., entitled, "On the Battle Line with the Telephone." During the lecture, which was a fitting tribute to the American Signal Corps, Mr. Carroll related many stories of the battle line, both heroic and humorous. The many difficulties encountered in the establishing and maintaining of communication lines during the war and the many ingenious methods by which they were overcome were clearly portrayed.

In addition to this address by Mr. Carroll, another glowing tribute was paid to our soldiers by Rev. C. Wallace Petty. J. M. Wakeman, president of the league, presided at the meeting.

NEW YORK ILLUMINATING ENGINEERS DISCUSS TRANSPORTATION LIGHTING.

Lighting Conditions in Piers, Docks and Warehouses Investigated and Reported to Meeting.

The New York Section of the Illuminating Engineering Society held a meeting Dec. 12, at the Engineering Societies building in that city. At this meeting A. L. Powell and R. E. Harrington delivered addresses on the subject, "Light as an Aid to the Transportation of Material." This subject which has received considerable attention of late, especially in regard to the importance of adequate lighting as a means of accelerating freight transportation was very fully treated. The report of a recent investigation of the lighting conditions found in piers, docks, warehouses, platforms, etc., was read and suggestions for their improvement were recommended.

ELECTRICAL MANUFACTURERS CEASE MUNITION WORK.

Plants Being Reconverted to Peace Products—Wagner Company Lays Off Many Men.

A number of electrical manufacturers who have devoted a large part of their manufacturing facilities to the production of shells and other munitions are changing their plants back for turning out their normal electrical products. Little difficulty is being experienced in doing this except in isolated cases. According to newspaper dispatches from St. Louis, Mo., the cancellation of government contracts for shell production has caused the Wagner Electric Manufacturing Co. of that city to dismiss between 800 and 1000 employes engaged in this work within the last 8 or 10 days, about 300 being laid off in one day alone. The company was one of the first St. Louis manufacturers to engage in munition work after the start of the war.

Commercial

Advantages of Central-Station Service in Coal Mining — Minimum Electric Rate Upheld by Utility Commission

ELECTRICITY SAVES LABOR IN COAL MINING.

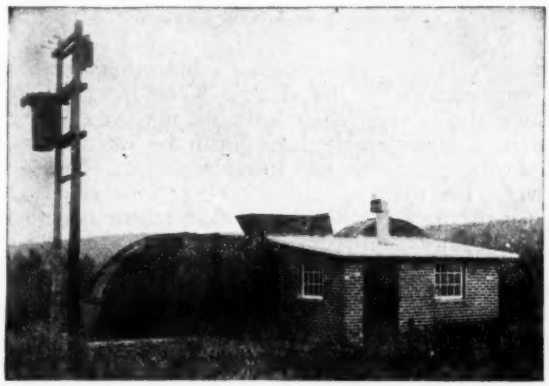
Possible Savings and Methods of Application Pointed Out. Advantages of Central-Station Service.

Labor-saving devices are of the utmost importance in the coal industry as well as in various other lines of work. The great increase in the previous large demand for coal, together with an increase in the cost of labor, makes it imperative that labor-saving devices be utilized to their fullest extent. It is a fact that previous to the acute conditions brought on by the war many mining companies had installed labor-saving equipment, but not to any such extent as has been done since the war, which demanded that no stone be left unturned to increase production.

There is a considerable opportunity for installing labor-saving devices on the present power equipment, due to the fact that the present equipment in many cases is very old and inefficient. Economics, where steam power alone is used, can be easily effected by the use of stokers, coal and ash-handling equipment, feed-water heaters and purifiers. Real economy, not only saving labor but also cutting down the cost of producing power, can be effected by replacing the steam with electric power, whether generated in an isolated plant or purchased from a central-station company. Compared with steam, an isolated electric plant will effect some saving in labor principally due to the higher efficiency of electrical apparatus. Where central-station power is available, greater economy can be shown both in labor and cost when compared

Coal-Mine Substation for Converting High-Voltage Power Supply to Requirements of Mine Operation. Westinghouse Synchronous Converter in Foreground Supplies Underground Trolley.

to an isolated electric plant. One case is cited of a mine in Alabama, which is operated entirely by steam. The water is obtained from a river pumping plant, which necessitated a separate boiler plant. The boiler plants alone require 20 men for their operation. If central-station power were used, practically all of this labor could be eliminated and a very great saving can be shown by the installation of a single isolated plant. Where the power used is steam, an engineer is necessary for each set of engines, as the engines are often widely separated. This means that a large number of engineers must be employed. Changing to electric



Electrically Driven Ventilating Fan and Housing for Large Coal Mine.

power will eliminate some of these engineers since a motor does not require the constant attention that a steam engine does. The elimination of the compressed air equipment is recommended wherever possible, as such apparatus is particularly inefficient in mine operation.

Great Saving Possible in Pumping and Ventilating.

The pumping of water is an important question in practically all coal mines. The amount of water to be pumped ranges from a comparatively small amount in some of the drift mines of bituminous fields to from 10 to 20 times the coal output in tons at some of the hard-coal mines. In the case where steam or compressed air is used, the operation is very inefficient. In the anthracite coal region of Pennsylvania this is particularly exemplified. It is a common sight in that region to see steam lines carried over the surface for long distances to a bore hole located at the pump. The condensation loss, especially in cold weather, in these lines often amounts to more than the amount of power used by the pump. The installation of automatic float-controlled electric pumps to replace these steam pumps would certainly result in a considerable saving in both fuel and labor. The portability of an electric pump is also of advantage here as the pumps must often be moved from one place to another.

It is desirable as well as important that the ventilation of a mine be most reliable. High efficiency is also desirable since the power required for ventilation often represents a large percentage of the total power. Here again the inefficiency of steam-driven apparatus

is apparent. In addition to the losses which occur in distribution it has been found that in many cases the fans are loaded to only a small fraction of their capacity but the cost of changing is too high to warrant it. Here again the flexibility of electrically-driven apparatus would result in a considerable saving.

Further economics are obtained by the substitution of electric power for animal or some other forms of mechanical haulage. The air locomotive is, of course,

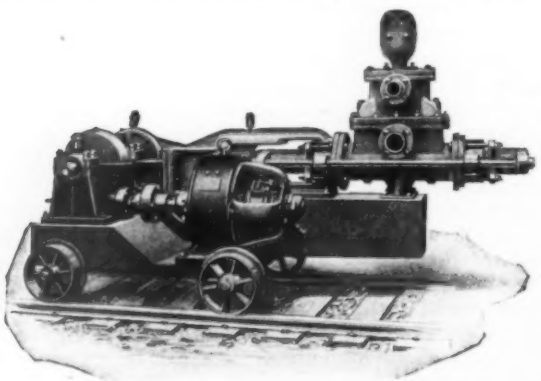
Baldwin-Westinghouse Electric Locomotive—Most Powerful Yet Built for Mining Service.

necessary in very gaseous mines, but otherwise offers no competition for the electric locomotive. A rope system also is very often desirable, but even with this system a considerable saving can be introduced by employing electric motors to replace steam engines for power. For main haulage, no other form of locomotion can compete with the electric motor due to the great distances and required speed.

A considerable amount of hoisting is necessary where vertical or steep slopes occur. Central-station service is particularly desirable for this class of service due to the heavy instantaneous demands for power made by this machinery and the number of hoists operated by electricity in localities where central-station service is available has shown a rapid increase in the past few years.

The principal labor saving, however, occurs in the adoption of electrically-driven apparatus in the actual digging of the coal. The breast, long and short wall chain-cutting machines offer the best example of labor saving and increased production. One of these machines, operated by two men, will do the work which formerly required from 20 to 25 miners. This machine will make a cut about 4 ft. high and 6 ft. deep across the entire face of a room in about 15 minutes.

Among the newer devices being tried out in both the anthracite and bituminous fields is a scoop-hoist. This device is particularly adopted to low coal. It



Portable Motor-Driven Pumping Set.

consists of a V-shaped scoop which is placed in position by a tail rope in the room containing the coal. It is then pulled out by means of a motor over an unloader, which deposits the coal directly in the car. This device, it is claimed, will replace several loaders.

Further new ways and means are constantly being devised to facilitate the saving of labor and increase production. Practically all these new methods utilize electric power in some form in their operation and it behooves the management of the steam-driven plant to electrify as soon as possible if he is to compete with the electrically-operated mine.

PENNSYLVANIA PUBLIC SERVICE COMMISSION UPHOLDS MINIMUM ELECTRIC RATE.

Recent Decision Calls Penn Central Light & Power Co. Charge Reasonable.

The Public Service Commission, Pennsylvania, has handed down an interesting decision in a case brought by the Borough Council of Lewistown against the Penn Central Light & Power Co. against a minimum rate charge of $1 per month for electric service and 75 cents a month for a "readiness to serve" gas charge as established by the company, holding that the public service law of the state allows the minimum charge and upholds a "readiness to serve" charge. In its decision the commission says:

"The reasonableness of minimum schedules has been firmly established and is specifically approved in the public service company law. The use of a separate charge to cover stand-ready costs is very general in electric power schedules and at the present time the trend is undoubtedly toward a wider use of this form of charge in gas, water and other utilities delivering a product. The public service company law does not prohibit its use either directly or indirectly. There is no distinction in principle between a system of minimum payments and a system of ready-to-serve charges. Both are predicated upon the same analysis of total cost of the service. Both recognize the element of 'stand ready to serve.' In a schedule with minimum payment requirements, the ready-to-serve costs are concealed in the rate per unit and in the minimum. In a schedule with a pure ready-to-serve charge these costs stand revealed. The commission has not adopted any fixed policy in the matter of a ready-to-serve charge, even though it has in several instances, under certain conditions and circumstances, approved its use."

In conclusion, the commission holds that the minimum monthly charge of $1 for electric service at Lewistown is not unreasonable and in the ready-to-serve gas-charge complaint the company is directed to file a graded system of ready-to-serve charges that will return practically the same revenue as would be received from a uniform ready-to-serve charge of 75 cents a month.

ELECTRIC SMELTING OF FERRO-MANGANESE ORES IN CALIFORNIA.

The Noble Electric Steel Co., San Francisco, operating two 3-phase electric furnaces of its own design at Heroult, Cal., has been smelting during this year an average of 400 tons of ferro-manganese ore per month, running about 45% manganese and 15% silica, making a 70% manganese product. The plant carries an electric load of 2600 to 3000 kw., alternating current, 60 cycles. Energy is supplied at 2000 volts by the Northern California Power Co., which is stepped down by the steel company's transformers to a variable voltage of 40 to 80.

Operating

Fuel-Saving Suggestions—Block Bus System of Distribution —Suggestions for Lighting of Switch and Disconnect Cells

HELPING POWER PLANTS SAVE COAL BY MAIL.

Seventh Letter Sent Out by Joseph Harrington Deals with Boiler Room Records.

Without proper station records, it is impossible to operate economically or uniformly. The seventh letter sent out to Illinois power plants by Joseph Harrington, administrative engineer, United States Fuel Administration, covers this matter as follows:

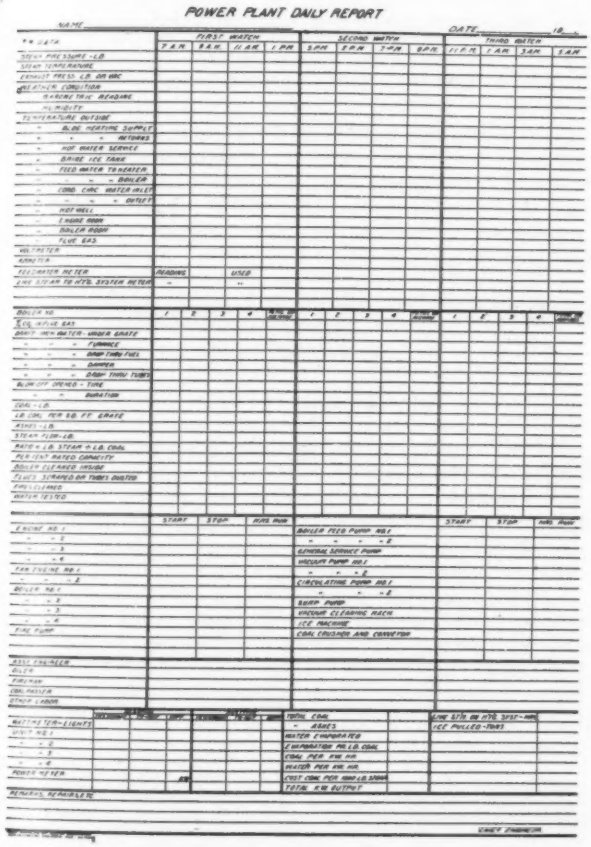


Fig. 1.—Daily Report That Answers the Purpose of Most Power Plants.

BOILER ROOM RECORDS.

"Before considering some of the other matters so necessary to boiler room efficiency, I want to have each and every reader of this letter make preparations at once for a proper accounting in his boiler room.

"You can no more analyze your boiler room situation without appropriate records than your auditor can analyze your production costs without a proper set of books. Practically all large power plants have some record system, but the vast majority do not; and in order to enable those of you who do not now have some such record, I have caused to be here produced records which will be suitable in practically all cases.

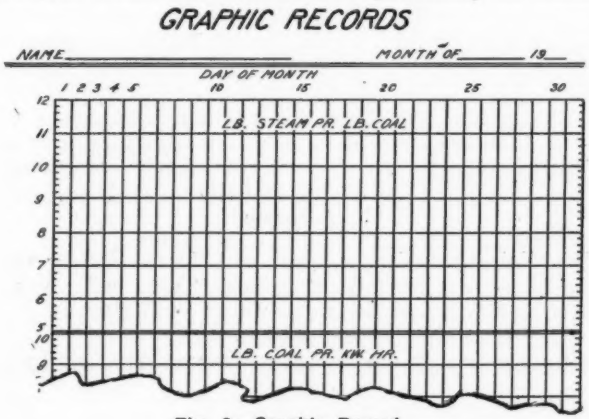


Fig. 2.—Graphic Record.

This should include such items as lb. steam per lb. coal, lb. coal per kw-h., lb. steam per kw-h., lb. steam generated, kw-h. generated.

"If you will faithfully fill out the columns in these forms, I will, at a later date, analyze each and every column and show just how it affects your efficiency. Not only will it enable you as plant manager to find out your costs, but it will enable you to analyze the results and determine where the losses are. You will then have a means of plugging up the leaks and fattening your pocket book.

"For those of you who are operating engineers, it

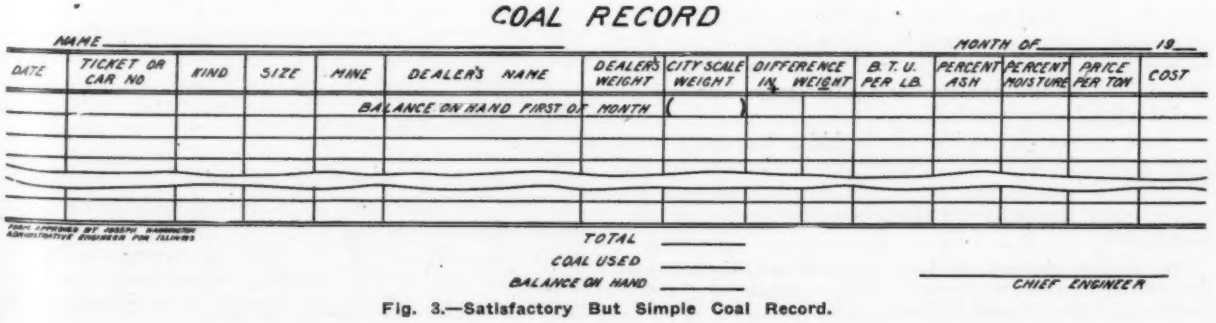


Fig. 3.—Satisfactory But Simple Coal Record.

will be the means of enabling you to keep tab on your plant conditions, and will shortly put you in possession of facts that will cause you to be proud of your record.

"Pride in your profession is an incentive which is sufficient for the engineers of Illinois. Let us get together and develop conditions which will make Illinois a leader among the States of the Union."

CONDENSED SUMMARY

NAME _____ MONTH OF _____ 19__

COAL USED		COST OF COAL	
WATER EVAPORATED		" WATER	
TOTAL KW. OR HP. OUTPUT		" OF LABOR	
LIVE STEAM FOR HEAT		" OF REPAIRS	
KW. OR HP. HR. POWER		" PR. KW. OR HP. HR.	
KW. HR. LIGHTS		" OF STEAM 1000 LB.	
ASHES MADE		" " SUPPLIES	
COAL RECEIVED		" " HEAT-LIVE STEAM	
COAL ON HAND			

OTHER SUPPLIES RECEIVED

IMPROVEMENTS AND NEW MACHINERY

CONDITION OF PLANT COMPARED WITH LAST MONTH

REMARKS

CHIEF ENGINEER

FORM APPROVED BY ILLINOIS ASSOCIATION ADMINISTRATIVE ENGINEERS FOR ILLINOIS

Fig. 4.—Condensed Monthly Summary of Power Plant Performance.

BLOCK BUS DISTRIBUTION IN STEEL MILLS.

Interesting Installation at Carnegie Steel Co.'s McDonald, Ohio, Plant.

What has been called the block bus system of distribution is employed at the Carnegie Steel Co.'s mills at McDonald, O. This method of distribution is especially applicable where large amounts of power are to be transmitted short distances to load connected closely together and each large individually, so eliminating double transformation.

In station construction, it is commonest practice to use a bus for distribution from large blocks of generating capacity to adjacent switching positions. In the McDonald installation the scheme is identical, the only change being the location of the bus switch at the load block, and the extension of the length of the bus between the supply and the load with the elimination of the lines otherwise necessary between the bus switch and the load center switch.

At a recent discussion of the block bus system of distribution in steel mills, after an inspection of the McDonald installation, R. J. Gaudy pointed out the salient advantages of the block bus distributing system as these:

1. The conductors are bare copper in air, which condition is the most advantageous possible considering the disposition of heat produced by losses.

2. The conductors are rigid and are ruggedly supported so that no difficulty can arise from mechanical stress developed magnetically.

3. The insulating medium is free from possibility of becoming moiture soaked and breaking down.

4. The conductor is insulated by a material which will not fail or deteriorate under temperature change. This feature is one which, for steel mill load, presents great advantage. Changes in the load requirements may occur on very short notice. Production in one portion of the mill may be doubled or trebled during a period which will not allow of procuring and installing additional distribution line material. The block bus system may be installed so that all characteristics are best selected for the anticipated loads, but when local or general increases come on there is absolutely no danger of failure due to temperature damage to insulation. This is of great advantage to the steel mill electrical engineer because his distribution will immediately take on a load addition which would be an undue overload on any other distribution having equal conductor in place.

5. The switch gear necessary for any loading is much reduced, for instead of a multiplicity of lines protected by individual switches and against each other, you install a bus line so well that it will not get into trouble and are limited only to the capacity of switch gear available, which is at this time no mean limit.

6. If the location of the load blocks suggest either a block bus line or loop, loads may be added at any point, requiring at the most only the addition of bars to the stack to restore accurate characteristics desired.

7. The possibility of failure due to overload is almost absolutely eliminated.

The block bus system at the McDonald installation consists of what is really a bus extension of copper, tapered in cross-section as the current density due the loads decreases, installed in a tunnel. It is understood to be the first installation made of this type of construction in a steel mill.

LIGHTING FOR CIRCUIT BREAKER AND DISCONNECT CELLS.

By B. B. Allison.

It is the practice among many companies to install barriers between circuit breakers, disconnect switches, potential and current transformers in the respective phases of circuits above 10,000 volts. It often happens that conditions are congested because of the massive dimensions and height of these cells.

Station lighting usually consists of a number of lighting units located on the ceiling, with additional units installed at various places of vantage. Notwithstanding all the interest and discussion accorded lighting of recent years, much remains to be done to improve the lighting of stations and illumination of switching rooms.

In a switch room or substation containing many switch or disconnect cells, it often happens that these are placed within a few feet of the walls, as close as feasible, in fact. In pulling the disconnect switches or inspecting the circuit breakers it is so often found that the illumination from the ceiling lights interferes with rather than improves the visibility in the cells and their contents. The ceiling lights when turned on only cause more intense darkness in the cell.

Operators when pulling disconnects are sometimes forced to carry a flashlight in their hand while doing so, because the station lighting is so badly placed. A portable lamp with cord is also used sometimes, being laid on the floor. Both these conditions are undesirable and may be hazardous under certain conditions. The installation of lighting units near the floor level would make the cells sufficiently light to do away with the need for further illumination. The need for such lights in many substations cannot be overemphasized.

Contracting-Construction

Determination of Contractor's Overhead Expense—Changes in 1918 Edition of National Code — Handy Splicing Tool

ACCURATE DETERMINATION OF "OVERHEAD" IN ELECTRICAL ESTIMATING.

Curve Designed by Chicago Electrical Estimators' Association Eliminates Guesswork in This Part of Estimate.

At a recent meeting of the Chicago Electrical Estimators' Association a chart of overhead percentages which are adapted to electrical contracting was presented. As was stated in the last issue of the ELECTRICAL REVIEW, this chart or curve offered the best solution to this problem thus far devised. The principle of the curve, although a departure from the usual method of figuring overhead expenses inasmuch as it uses the cost of each individual job as a basis instead of the total annual cost or volume of business, is much better adapted to electrical contracting than these methods.

The occasion at which it was introduced was a dinner given by the association to W. L. Goodwin. In presenting this curve, E. L. Morley, member of the executive committee of the association, explained very clearly the method of its application and the reason for its adoption in the following address.

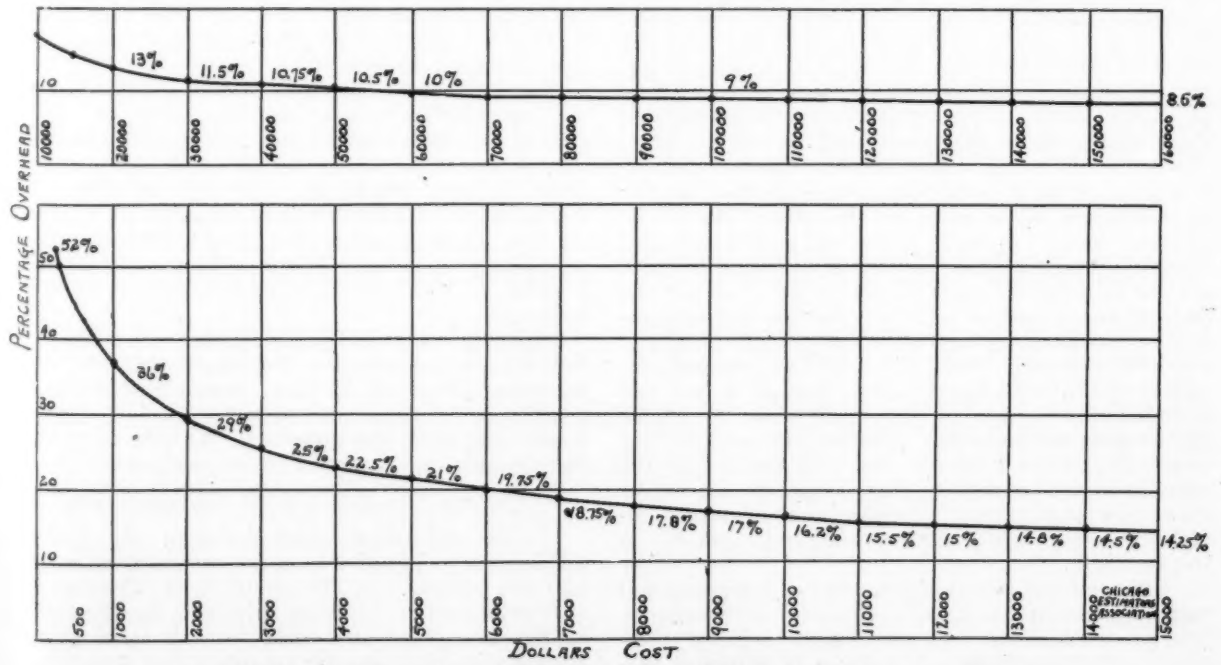
MR. MORLEY'S ADDRESS.

In this discussion, it must be borne in mind that the subject of overhead expense is to be regarded only in its relation to the electrical contractor. Overhead is probably the least understood and most unruly item entering into the finished estimate to be submitted to a client for consideration. However, remembering the success which crowned this association's efforts in solving the labor cost problem and having drawn up estimate forms in which the various other items could be assembled, it attacked this new task very well prepared.

The first question to present itself to the committee was: What does overhead consist of? Several descriptions were given, all of which were more or less vague. One described it as the ratio of the annual cost of doing business to the total volume of sales; another, the ratio of the annual cost of doing business to the volume of sales less the profit; and still another, the ratio to the actual cost of labor and material during the year. From any of these descriptions only average percentages are obtained and therefore do not give percentage of overhead to be added to the estimated cost of any particular installation.

In all previous discussions of overhead, it has been proven that when determined in accordance with one of the foregoing descriptions for any year, it will not always apply for the next year, as the volume of business may change and other conditions vary. This is at once an admission that such an overhead percentage is of little value. It won't even apply to any one day, week or month in the year for which it was computed, why expect it to apply for any other year?

It has also been stated that the overhead percentage of contractors doing a large volume of business is less than that of the small contractor. This is true but not the whole truth. Any large contractor who thinks his overhead on a small job is less than the small contractor's is fooling himself. The real reason for the



Curve of Overhead Percentages Designed by Chicago Electrical Estimators' Association.

large volume of business being carried on with a lower overhead percentage is due to other causes than volume.

The committee finally decided to accept the ratio of the cost of doing business to the cost of installation as a basis to begin their investigations. It will be noted that this does not mean annual costs. If such percentages could be found it would be a simple matter to apply them to the estimated cost of installation and obtain the estimated net cost of the work. A suggestion had been adopted that a curve of overhead percentages be plotted and it became necessary to decide what this curve should represent. The original suggestion was to plot percentages in relation to the annual volume of business. This, of course, was at variance with the decision to use the cost of installation.

Before going any further into this question it may be well to cite an example of the various workings of the so-called overhead and how they affect the contractor's profits. The John Jones Co. calls up for an estimate on alterations and additions to the wiring in their building. An estimator is sent and requires an hour or more to reach the location, waits 15 minutes to see proper party, spends an hour going over work, returns to the office and makes up installation cost as approximately $1000. Estimator's time, one day. Should the average overhead be added? A contractor doing so and closing the contract will be losing money on that particular job, unless the average estimated cost of installation of his jobs is $1000 or less. To prove this—how many $500 and $1000 jobs does a contractor figure and how many of these does he close? An average of 10% is probably high. The overhead for any particular cost estimate must include as nearly as possible the expense of estimating similar work which was not closed.

Let us follow this job after it is closed by a contractor who has added 20% to his labor and material cost for overhead and 15% to this net cost for profit; a total of 38% above estimated cost, or $1380. The contractor, if he has been fortunate, has only estimated nine other similar jobs which were not closed. Each has had an estimating cost averaging not less than $10, probably more. Fifty per cent of the overhead is gone and the job only closed. The next demand is a job ticket and this costs at least as much for a $1400 job as for a $10,000 one and probably more, as there are no plans and specifications and the ticket must give an accurate description of the work. The mechanic is then made familiar with the work by either coming to the office or meeting the estimator or superintendent at the job. All this is lost time. The material list is then made up and the orders sent out. The time and material cost for these items is much greater in proportion for the $1400 job than for the $10,000 one. And so on along the line for superintending, bookkeeping, and all other items entering into overhead expense. When the work is completed, the overhead has been nearer 40% than 20% and has included all or part of the expected profit. The contractor does not know this if he has not separated his overhead for this particular job. At the end of the year, however, he realizes that the profits are not as great as were expected from what was considered liberal percentages added for overhead and profit on the smaller work.

After several stories similar to the foregoing and many discussions, a curve was developed by using a few points obtained from actual data given by members of the committee. The curve is drawn in two parts, the lower portion, being the more important, is drawn with the large divisions representing $1000 each while in the upper portion they show as $10,000 each. Always bear in mind that the dollars cost represent the estimate sheet cost and that the overhead percentage applies directly to this cost. By estimate sheet cost is not meant simply the estimated cost of labor and material, but also includes all items directly chargeable to the jobs such as bond, if any, liability insurance, drawings, inspection, freight, cartage, railroad fares, board, etc.

In order to facilitate the reading of this curve it has also been arranged in a tabulated form as follows:

Estimate-sheet cost.	Percentage of overhead.
$ 200	52.0
500	42.0
1,000	36.0
2,000	29.0
5,000	21.0
7,500	18.25
10,000	16.2
25,000	12.2
50,000	10.5
100,000	9.0
160,000 and above	8.5

The small contractor doing an annual business of $20,000 to $40,000 will find the job costs falling on the curve from $200 to $5000 with the larger proportion near $1000 or less. From $50,000 to $100,000 the job costs will fall larger around $2000 to $5000. The large contractor doing $250,000 to $500,000 will find the jobs on the flatter portion of the curve from $10,000 up.

From this it can be seen that the apparent lower overhead of the larger contractor is due, not to the fact that the volume of business is greater, but is due to the lower percentage of overhead which the larger contracts carry. Irrespective of the yearly volume of business, each estimated job should be apportioned its proper overhead percentage, as determined by its size, instead of an average percentage obtained from the annual cost of conducting the business and volume of same.

In using a curve of this character it is easy to check at the end of the year whether the overhead percentages are correct or not by tabulating the cost of all jobs and applying to each the proper percentage of overhead according to its size. The total should approximate the amount shown on the books as the cost of doing business.

Let us consider the application of the curve where the volume of business increases or decreases. If the volume decreases materially it is usually due to fewer of the large jobs and a portion of this may even be offset by more small ones. As the small jobs carry the larger overhead it is readily seen that the overhead tends to automatically adjust itself where an average percentage would not. This also applies to an increase in volume. The increase being usually to more of the larger jobs.

With this system of applying overhead it is evident that the large contractors bidding on the small work in competition with the small contractors should use practically the same percentage and in doing so, if he obtains the work, not rob the larger jobs of profit to pay the overhead expenses on the small ones.

Use of Curve Strongly Recommended.

In the discussion which followed Mr. Morley's address the value of this curve to electrical contractors was brought out. The extent of its value was very well expressed by Mr. Goodwin, who in commenting on the curve, expressed some doubt as to its absolute accuracy in every possible condition, but stated that it

was so much better than any previous system that he strongly recommended its immediate adoption by contractors all over the country.

In order to improve the accuracy of the curve to cover various conditions, such as the extras which are necessary in many buildings, it was suggested that when such extras are added, an overhead proportionate to their size be added to their cost. This, it is expected, will permit the use of the curve to cover all installations.

In order to bring out more fully the application and accuracy of the percentages shown on the curve and to show the relation of these percentages on cost as applied to the selling price, the following table was arranged. In these figures 10% was allowed for profit as it must be remembered that the percentages shown on the curve represent the overhead to be applied to the actual cost as shown on the estimate sheet and do not include any allowance for profit. It was found that a business which totaled $50,000 a year was made up of jobs averaging approximately $500, selling price, and costing in labor and material about $300. By comparing the percentages in the right column with those shown on the curve, for a similar business, it will be found that the resultant average percentage for a year practically coincides with the percentages on the curve.

Annual sales.	Cost.	Overhead expenses.	Overhead on sales.	Percentages on cost.
$ 50,000	$ 30,000	$15,000	30	50
100,000	66,000	24,000	24	36
150,000	105,750	29,250	19½	27½
200,000	146,000	34,000	17	23
250,000	187,500	37,500	15	20
300,000	229,500	40,500	13½	17
350,000	271,250	43,750	12½	16
400,000	312,000	48,000	12	15
500,000	392,500	57,500	11½	14¾

The necessity of some method of equalizing contractor's bids and thereby stabilizing the electrical contracting business as a whole has been recognized for many years. The wide variance in electrical estimates has very often forced manufacturers to resort to the questionable remedy of doing their own wiring in the past and the poor results usually obtained from this procedure have in turn caused these men to regard the whole electrical industry as a doubtful proposition. The value of this curve in this respect has already been proven in Chicago, where formerly bids commonly varied as high as 100% and frequently much higher. Recently a contract was signed amounting to $12,000 in which the difference in six bids from the highest to the lowest was only $800. Bids of this sort will certainly give the customer a much better impression of the reliability of the electrical contractor than those which cause him to believe that electrical work is largely a matter of guessing.

Actual Results Obtained from Use of Labor Data.

At this time it might be well to note the accurate labor estimates which can be obtained by using the labor units which were compiled by this association. In a recent installation in a factory in Chicago there was 3090 ft. of ½-in., 500 of ¾-in., 900 ft. of 1-in., and 130 ft. of 3½-in. conduit installed. Using the labor estimate units, the following figures were obtained as the cost of installing this conduit complete:

3,090 ft. ½ in. at 5 cents	$154.50
500 ft. ¾ in. at 7 cents	35.00
900 ft. 1 in. at 9 cents	81.00
130 ft. 3½ in. at 42 cents	54.60
194 ceiling outlets, 25 cents	48.50
145 ceiling switch outlets, 25 cents	36.50
2 cutout boxes set, 46 circuits, 50 cents	23.00
Total	$433.10

The actual labor required to do the work was found to be:

18 days, foreman at $7.50	$135.00
43 days, wireman at $7.00	301.00
Total	$436.00

COMPLETE LIST OF CHANGES IN NATIONAL ELECTRICAL CODE.

Second Half of Code Changes Contributed by President Devereux of the National Association of Electrical Inspectors.

Class D. Under Heading.—Revised; describes only the general characteristics of fittings and materials commonly employed in electrical equipments, for the installation of which regulations are given in Classes A, B, C, E and F. Addition gives general features of test requirements, of bases, terminal parts and markings.

Rules 49 to 57. Fine-print notes under heading.—Par. 1 transferred to Rule 49 *a*. Par. 2 and 3 omitted.

Rule 49a, par. 2.—Omitted.

Rule 49b.—Transferred from Rule 49*a*. First sentence changed to except weatherproof wire. Second sentence refers to all wires, cables and cords.

Rule 49b.—Omitted.

Rule 50, Classification.—Changed from type letters RS to R.

Rule 50c, par. 8.—Omitted.

Rule 50d.—Omitted.

Rule 51.—Three-line paragraph under heading omitted.

Rule 51h.—Reference to building up of wires omitted.

Rule 51d, par. 2.—Condensed.

Rule 51d, table.—Heading of last column changed to read, see also. Reference to Rule 51*g* omitted in fourth item. Reference to 51*h* in fifth item omitted. Reference to 51*g* and *i* omitted in sixth item. Reference to 51*g* and *j* changed to 51*h* in seventh item.

Rule 51g.—Transferred from Rule 51*h*. Former Rule 51*g* omitted.

Rule 51h.—Transferred from Rule 51*j*.

Rule 51i.—Transferred from Rule 51*k*. Former Rule 51*i omitted.*

Rule 51i, item 2.—The word "must" changed to "may." Reference to thicknesses omitted.

Rule 51i, item 3 (new).—Requiring other types of covering to be submitted for examination and approval.

Rule 52.—Addition of reference to Rule 38 in italic subheading.

Rule 52a, par. 2.—Reference changed to 30*c*, 35*d* and 77*c*. "Other fire-resisting coverings" added.

Rule 52d, par. 1.—Reference to tests omitted.

Rule 52e.—Addition, braid must be sufficiently tenacious to withstand abrasion when pulled into fixtures.

Rule 54a.—Transferred from Rule 54*c*, former sec. *a* being omitted.

Rule 54b.—Transferred from Rule 54*d*, former sec. *b* being omitted.

Rule 56.—First paragraph under heading transferred from Rule 56*b*, par. 2. Second par. under heading exempts special fixture wires made up as per 52*a*, par. 2.

Rule 56a.—Description of filling compound condensed and requirement that outer braid be designed to withstand abrasion omitted.

Rule 56b.—Reference to requirement of 49*a* omitted.

Rule 57.—Paragraph under heading transferred from Rule 57*b*, par. 2.

Rule 57a, par. 1.—The words "which must comply with the specified requirements" omitted.

Rule 57b.—Reference to requirement of 49*a* omitted.

Rule 58a.—Transferred from Rule 58*d*, and the words "elbows, bends and similar fittings" added, and "one of the following" omitted. Former sec. *a* omitted.

Rule 58b.—Transferred from Rule 58*i*. The word "rigid" added before conduit in first line, and reference to weight and inspection omitted.

Rule 58c.—Omitted.

Rule 58d.—Transferred to 58*a* and condensed.

Rule 58e, f, g, and h.—Omitted.

Rule 58i.—Transferred to Rule 58*b*, and weight table omitted.

Rule 58j, k, l, m and n.—Omitted.

Rule 59a, par. 1.—Addition specifying size of junction or pull boxes, and last sentence transferred to par. 2.

Rule 59a, par. 2.—Transferred from last sentence of par. 1, and addition describing construction of boxes.

Rule 59c, par. 2.—Addition including conduit-box covers and giving requirements adaptable to flexible cord.

Rule 59d.—Transferred from Rule 59*e* and par. 2 and fine-print note of same combined. Former sec. *d* omitted.

Rule 59e.—Transferred from Rule 59*f*.

Rule 59f.—Transferred from Rule 59*g*.

Rule 59g.—Transferred from Rule 59*h*.

Rule 60.—Heading changed from "Mouldings" to "Raceways for surface wiring."

Rule 60a and b.—Heading changed to read "Wooden Raceways."

Rule 60c.—Heading changed to read, *Metal Raceways.*

Rule 60c (new).—Requires construction to distinguish from metal conduit; reference to marking and fine-print note omitted.

Rule 60d.—Reference to construction omitted and protection against corrosion must be approved.

Rule 60e.—Condensed and last sentence transferred from Rule 60*g* and reworded.

Rule 60f, g and h.—Omitted.

Rule 61.—Heading changed to read "Cleats, knobs, tubes and bushings."

Rule 61a.—Heading omitted and section reworded, requiring approved material.

Rule 61b (new).—Requiring cleats or split knobs for larger than No. 4 wire to have two supporting screws. Reference to material and test omitted.

Rule 61c.—Heading changed to read "Spacings."

Rule 61c, par. 1 (new).—Requiring ¼ in. separation between screw or nail and conductor. Reference to marking omitted.

Rule 61c, par. 2 and table.—Transferred from Rule 62*e*.

Rule 61c, par. 3.—Transferred from Rule 64*e*, first part of sentence.

Rule 61d.—Heading changed to read "Dimensions." Second table (for knobs) transferred from Rule 64*e*.

Rule 62.—Omitted and left blank for future use.

Rule 63.—Italic-print note under heading omitted.

Rule 63.—Text transferred, combined and condensed from Rule 63*a, b, c, d, f and g.*

Rule 63e, h and i.—Omitted.

Rule 64.—Omitted and left blank for future use.

Rule 65.—Fine-print note and paragraph under heading added describing a knife switch.

Rule 65a.—Refers to marking and rating of switches. Transferred from Rule 65 and revised.

Rule 65b, par. 1.—Transferred from Rule 65*d*, and reference to countersinking and covering of screw heads omitted.

Rule 65b, par. 2.—Transferred from last sentence of Rule 65*g*.

Rule 65c.—Transferred and condensed from Rule 65*k* and tables (except No. 1) changed and an addition requiring switches above 1000 amp. not to break current.

Rule 65d, par. 1 (new).—Requiring to conform to Rule 67*a* and 68*g*.

Rule 65d, par. 2 (new).—Permitting the use of multiple fuses on switches rated above 400 amp., 600 volts and 600 amp., 250 volts.

Rule 65d, par. 3 (new).—Prohibiting fuse terminals on switches of combined rating.

Rule 65d, par. 4 (new).—Fused switches for branch circuits must have fuse terminals in each pole.

Rule 65e.—Transferred from Rule 65*k*, item 4, and addition to include 600-volt switches from 200 to 1000 amp.

Rule 65f (new).—Describes construction of barriers.

Rule 65g (new).—Describes separation between live metal parts of multiple-pole switches.

Rule 65a, b, c, e, f, h, i, l, m, n, o, p, q, r, s and t.—These sections of former rule omitted.

Rule 66.—Italic-print reference and note under heading omitted.

Rule 66 (new).—Describes main features of construction of circuit-breakers. All of former Rule 66 omitted.

Rule 67.—Heading changed to read "Cutout Bases."

Rule 67.—Addition of Rule 42 in italic-print reference.

Rule 67a.—Transferred from Rule 67*j* and par. 2 of fine-print note omitted.

Rule 67b.—Transferred from Rule 67*m* and given heading "Fuse Terminals.'

Rule 67c.—Transferred from Rule 67*o*.

Rule 67a, b, c, d, e, f, g, h, i, k, l, n and p.—These sections of former Rule omitted.

Rule 68.—Addition of Rules 8*c*, 25*a* and 33*a* in italic-print reference.

Rule 68a.—Heading changed to "Contact Tips" and addition specifying kinds of metal.

Rule 68b.—Fine-print note omitted.

Rule 68c.—Transferred from Rule 68*d* and "wire" changed to "link."

Rule 68d.—Transferred from Rule 68*e*. .

Rule 68e.—Transferred from Rule 68*c*, and addition to require "N. E. Code Std.", labeled capacity and colored paper label.

Rule 68h, i, j, k.—These sections omitted, except table of dimensions, which is transferred to Rule 68*g*. Fine-print note following table of dimensions omitted.

Rule 69b.—Last paragraph of fine-print note omitted.

Rule 69c.—Omitted.

Rule 70.—Fine-print note preceding section *a* omitted.

Rule 70a.—Combined and condensed from former Rules 70*a* and 70*b*.

Rule 70b.—Requirements of large cabinets transferred from former sec. *a*.

Rule 70c.—Consulting of detailed specifications omitted.

Rule 70e, f, g and h (new).—Describes construction of wood and composition cabinets.

Rule 71.—Fine-print note omitted. Reference to installation rules.

Rule 71a, par. 1 and 2.—Omitted.

Rule 71b.—Heading changed to read "Rating." Transferred from Rule 71*g* and requiring of marking omitted.

Rule 71c.—Heading changed to read "Fuses." Transferred from first line of Rule 71*h* and reference to operation omitted.

Rule 71b, c, d, e and f.—Omitted.

Rule 72b.—Transferred from Rule 72*d* and requirements of material and length of lamp bases omitted.

Rule 72c.—Transferred from Rule 72*m*.

Rule 72d.—Transferred from Rule 72*p*, and par. 1 and reference to spacing omitted.

Rule 72b, c, e, f, g, h, i, j, k, l, n, o and q.—Omitted.

Rule 73.—Omitted and left blank for future use.

Rule 74.—Omitted and left blank for future use.

Rule 75.—Omitted and left blank for future use.

Rule 76.—Fine-print reference to detailed specifications and tests omitted.

Rule 76c, d and e.—Omitted.

Rule 77.—Reference to Rule 35 added in italic-print note under heading.

Rule 77a.— Par. 2, 4 and 7 of former rule omitted.

Rule 77a, par. 4.—Addition requiring the prevention of the turning of arms and sockets.

Rule 77b, par. 2.—Transferred from Rule 77*b*, par. 3. Par. 2 and table of former rule omitted.

Rule 77b, par. 3.—Transferred from Rule 77*b*, par. 4, and withdrawing of wires for inspection of splices omitted.

Rule 77b, par. 4.—Transferred from Rule 77*b*, par. 6.

Rule 77b, par. 5.—Omitted.

Rule 77c, par. 1.—Requirements of unthreaded arms omitted.

Rule 77c, par. 3.—Reference to slow-burning and similar wires reworded. Former par. 3 omitted.

Rule 77c, par. 4.—Transferred from par. 5 and condensed.

Rule 77c, par. 5.—Transferred from par. 7. Former par. 6 omitted.

Rule 77d and e.—Omitted.

Rule 78a.—Heading changed to read "Types." All of this former section omitted, except par. 1 of fine-print note.

Rule 78b.—Heading changed to read "Mounting." Former par. 2 omitted.

Rule 78c.—Transferred from Rule 78d, and marking of maker and rating omitted. Former section *c* omitted.

Rule 78d.—Transferred from Rule 78*e*; reference to detrimental wiring in par. 2 omitted; fine-print notes omitted.

Rule 78e.—Transferred from Rule 78*f*.

Rule 78g.—Omitted.

Rule 78h.—Omitted.

Rule 79.—Construction and tests of autostarters in italic-print note omitted.

Rule 79a.—Heading omitted.

Rule 79b.—Transferred from Rule 79*a*, par. 3. Former sec. *b* omitted.

Rule 79c.—Transferred from Rule 79*a*, par 4. Former sec. *c* omitted.

Rule 79d.—Transferred from Rule 79*a*, par. 5. Former sec. *d* omitted.

Rule 79a, par. 6.—Omitted.

Rule 79e.—Omitted.

Rule 81.—Heading changed to read "Air-Cooled Transformers."

Rule 81, par. 1 of fine-print note.—Omitted.

Rule 81a.—Heading changed to read "Mounting;" par. 1, 3 and 4 omitted.

Rule 81b.—First sentence transferred from Rule 81*d*; second sentence transferred from Rule 81*e*, and rating changed to 250 volts, and reference to marking omitted.

Rule 81.—Former sections *b, c, f, g, h* and *i* omitted.

Rule 82.—Omitted and left blank for future use.

Rule 83b, par. 3.—Reworded and separated into two paragraphs.
Rule 83c.—Transferred from Rule 83*d*. Former section *c* omitted.
Rule 83d.—Transferred from Rule 83*e*, and the words "For open work" prefixed to par. 7.
Rule 83e.—Transferred from Rule 83*f*.
Rule 83f.—Transferred from Rule 83*g*.
Rule 86.—Italic-print paragraph under heading changed to read from: "all wiring within the building," to "all wiring pertaining thereto."
Rule 86a (new).—Describes the method of installing aerial supports and conductors.
Rule 86b.—Transferred from Rule 86*a* and changed to permit the use of No. 6 B. & S. gage copper wire, and of other ground specially permitted in writing.
Rule 86b.—Former section omitted.
Rule 86e.—Reference to grounding and capacity of condensers omitted.
Rule 86f (new).—Requires transformers, voltage reducers or similar devices to be of approved type.
Rule 88, par. 1.—"Where a test of the wiring of a building is required by the Inspection Department" prefixed to rule.
Rule 91a.—Word "mouldings" changed to "raceways."
Rule 91g.—Word "mouldings" changed to "raceways."
Rule 93a.—Word "moulding" changed to "raceway."

NEW TOOL FOR MAKING JOINTS IN SMALL WIRES.

By C. H. Willey.

The wire-splicing tool shown in Fig. 1 will be found suitable for splicing small steel, iron and copper wire which is too stiff to be readily bent with the

Fig. 1.—Handy Splicing Tool for Splicing Stiff Wires.

fingers. It can easily be made of cast iron or any other metal which will afford the necessary strength. It is about 8 in. long and at the widest part is approximately 3 in. wide. The curved head or holding part is about 1½ in. wide. This head is bent to form a semi-circle having a diameter of about ¾ in. The grooves in the flanges on each side should be deep enough to hold the wire without slipping out and the shoulder of the flange should be low enough to permit the wire to be grasped easily.

The operation of the tool can best be explained by the illustration as shown in Fig. 2. One of the wires to be spliced should be bent at right angles and the tool placed over it at the bend. The other wire is then put in position and both wires held in place with a pair of pliers. By turning the splicing tool, as shown in Fig. 2, the wire to be bent can be wound tightly around the other wire. After this the other wire can be bent and the operation repeated except that the tool must be turned in the opposite direction.

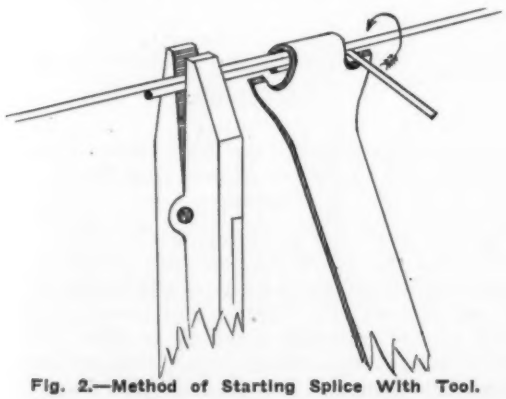


Fig. 2.—Method of Starting Splice With Tool.

One distinct advantage which a tool such as this possesses is that the finished joint is free from the

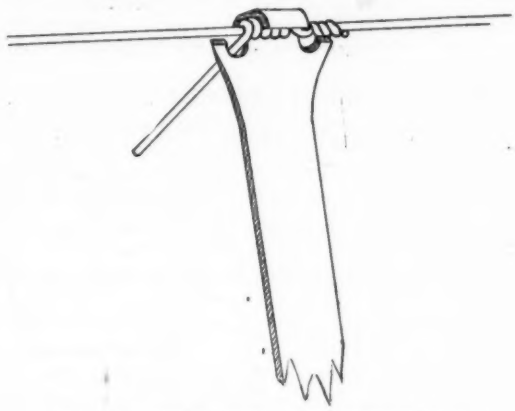


Fig. 3.—Finishing Splice With Splicing Tool.

usual outstanding ends which very often cut through the insulation, causing short-circuits or grounds after being in service a short time.

GIVING FREE OUTLET TO PASS BRIDGING IN PARTITION.

By J. A. Wever.

Sometimes when fishing a partition on which the wall coverings are new, you have the ill luck to strike a heavy piece of bridging which cannot be bored through from above, and the owner, being particular, will not consent to having a hole cut in the plaster and patched up again. I have found that a good way out of this difficulty, provided both sides of the circuit are being carried past the point, is to offer to give a flush receptacle free and place the outlet at the obstruction. This outlet, if it is not above bracket height, will be suitable for attaching a fan or piano lamp. The bridging should be notched deep enough to allow all wires beside the circuit pair which are carried through the box to be placed behind it when the latter is set flush. The good will of the pleased owner in such a case is well worth the added expense of the fittings.

The Hatfield Electric Co., Indianapolis, Ind., has under way the electrical work on a large office building being erected at Youngstown, Ohio, for the Home Savings & Loan Co. The structure comprises 10 stories and basement and is surmounted by a tower bringing the final height to about 200 ft. Its total cost is to be about $800,000, of which the electrical installation complete and including 5 electric elevators will amount to nearly $50,000. The upper part of the tower will be floodlighted. Below the illuminated clock dial on each face of the tower will be an electric sign built into the terra-cotta surface; it will show the bank's symbol "5%" with the figure 5 about 11 ft. high. The wiring for light and power is all to be in conduit; provision will also be made for telephone and electric clock wiring. Heller Bros. & Co. are the general contractors.

New Appliances

Improved Compensator — Marine Snap Switch — Impulse Gaps for Lightning Arresters—Greene Electric Arc Furnace

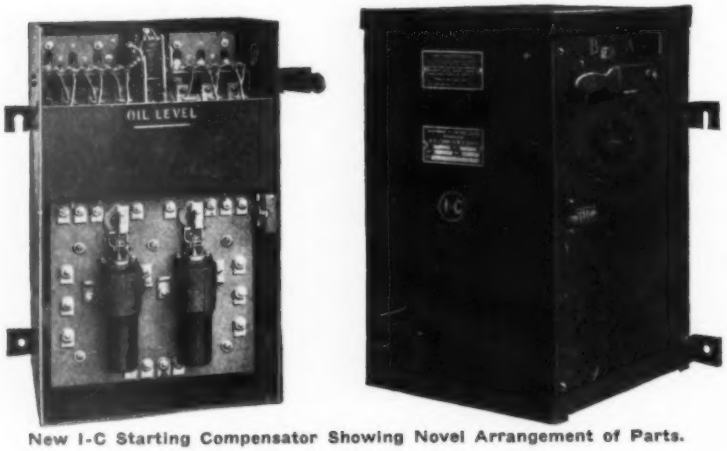
NEW COMPENSATOR CONTAINS SEVERAL DESIRABLE FEATURES.

The greater number of compensators or alternating current auto-starters have, for the past several years, been built more or less along the same lines, having drum-switch arrangements and removable oil tanks. For this reason a new compensator recently put on the market by the Industrial Controller Co. of Milwaukee, Wis., will doubtless prove of considerable interest to the electrical trade. This new I-C compensator is designed so that the entire device, including the switch mechanism, transformer, no-voltage release and time-limit-overload relay, is enclosed in a single dust-tight steel housing, which is arranged for wall or floor mounting.

The switch mechanism, which consists of two 3-pole quick-break sliding-contact switches, operates within a stationary oil tank situated in the top part of the casing. This mechanism is designed so that it may be very easily raised from the oil tank for inspection and repair, the mechanism revolving about the operating shaft.

The transformer element of the compensator is attached to the back panel of the casing and mounted directly below the oil tank. At the front of the transformer there is attached a panel containing the time-limit overload relays, which panel, in addition to these relays, contains terminals for the line and motor leads, as well as the transformer tap terminals. One very interesting feature which the manufacturers claim for this compensator is that all transformer taps are brought to terminals on this panel and in changing the transformer taps, which is advisable in many installations, it is necessary only to remove the casing cover and change these leads from one terminal to another, an operation requiring but a very few minutes time.

This compensator is arranged for conduit wiring, the casing being fitted with knock-outs for conduit connections at the sides and at the bottom. Another feature is the stop button which is placed at the side of the casing for stopping the motor, and it is possible to arrange for several such buttons at remote points when this is desired.



New I-C Starting Compensator Showing Novel Arrangement of Parts.

SNAP SWITCH FOR MARINE USE.

The snap switch illustrated is one of the Bryant devices for marine purposes. The base is of unbreakable moulded composition with the rachet plates moulded in.

While this rachet plate must necessarily be made of steel, in order to withstand the severe service expected of such a part, it is heavily copper-plated to prevent rusting. The music-wire spring which actuates the mechanism is also heavily copper-plated.

This switch is made in both the single and double-pole types and for either type a 3/8-in. extension stem for the handle is offered for use where water-tight covers are employed

Bryant Snap Switch for Marine Service.

As will be noted from the illustration a groove is provided on the back of the base which is large enough to permit the running of a separate circuit through the box. Two of these switches may be mounted in a standard 4-in. box.

IMPULSE GAPS FOR LIGHTNING ARRESTERS.

Westinghouse Development for High-Voltage Arresters to Give Added Protection Against High-Frequency Surges.

Impulse gaps for lightning arresters are recommended for use in connection with arresters which protect stations of large capacity operating at 11,000 volts and higher. The impulse gap excels every other known gap in assisting arresters to give protection from lightning and other high-frequency or high-voltage disturbances. The impulse gaps described are

for use in connection with electrolytic or other three-phase lightning arresters now in service for circuits with grounded or ungrounded neutral.

The impulse gap developed by the Westinghouse Electric & Manufacturing Co., East Pittsburgh, Pa., protects the insulation against high-frequency or steep-wave-front surges of high potential at a lower voltage, it is claimed, than does any other known gap.

The old-fashioned plain horn gaps had considerable time lag, allowing a high-frequency surge to rise to a much higher voltage than would a low-frequency surge before discharging and giving protection. The development of the sphere gap partly prevents this situation by eliminating the time lag, so that all frequencies are discharged at the same voltage. The new impulse gap has a negative time lag, that is, the higher the frequency the lower the voltage at which the gap discharges. Thus the impulse gap automatically selects the dangerous surges and gives protection more quickly than any other known form of gap.

The impulse gap not only incorporates all of the virtues of the horn gap and the high-speed sphere gap, but also possesses the property of selecting high-frequency or steep-wave-front surges and discharging them at a lower voltage than the normal voltage setting of the gap. It should be particularly noted that the impulse gap is the only device which will protect insulation against a steep-wave-front surge of reverse potential—that is, a sudden drop in voltage. The high-frequency discharge voltage may be as low as two-thirds, or even one-third, of the normal-frequency value. It is, therefore, possible to use a gap setting that will permit of the desired degree of protection against dangerous surges while not permitting too frequent discharging on minor surges at normal frequency.

The high speed of the sphere gap as compared with the horn gap is due to the elimination of the time required to build up a sphere of equal-potential surface at the discharge part of the horn gap. The sphere of equal-potential surface practically eliminates corona and reduces field distortions when the gap is set equal to, or less than, the sphere diameter. By the use of the sphere gap the voltage to ground, or the breakdown voltage, at any frequency does not materially exceed the 60-cycle discharge voltage of the gap. However, the sphere gap does not give the desired protection against steep-wave-front, or high-frequency surges, due to its inability to discharge these disturbances at lower voltage than the normal-frequency setting of the gap. It is necessary, therefore, to set all arrester sphere gaps for a sufficiently high normal-frequency voltage to insure proper functioning with high-frequency surges.

However, with the impulse-gap arrester, the normal-frequency setting of the gap can be had without the corresponding disadvantage of reduced protection, since the high-frequency breakdown value of the gap is much lower. This is because high-frequency discharges start from the auxiliary electrode and have only one-half of the gap to jump. The latter electrode also is so shaped that although the gap is one-half of the main gap, the breakdown voltage is only about one-fourth as great—that is to say, high-frequency surges are not delayed in discharging, as with plain horns, by the need of building up a static field, but instead, discharge at a voltage even lower than the normal value of the main gap, since they automatically select the auxiliary gap of much lower voltage breakdown.

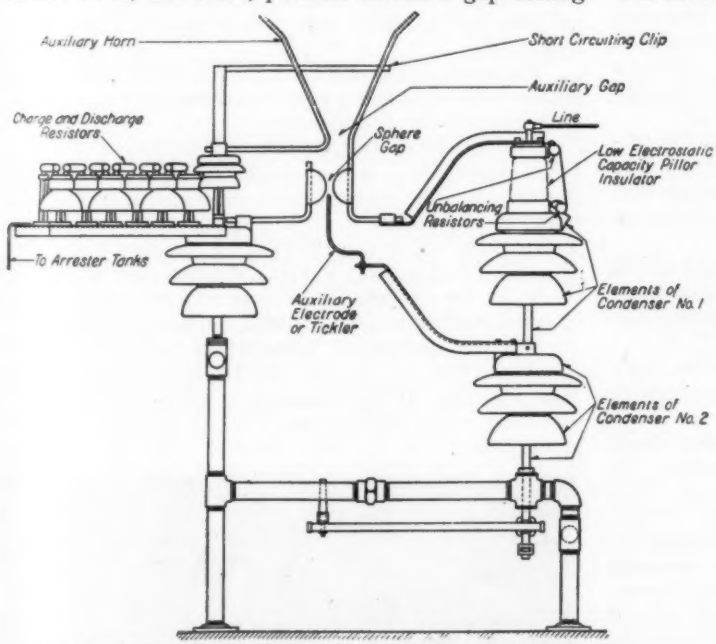


Fig. 1.—Typical Westinghouse Impulse Gap for Lightning Arrester.

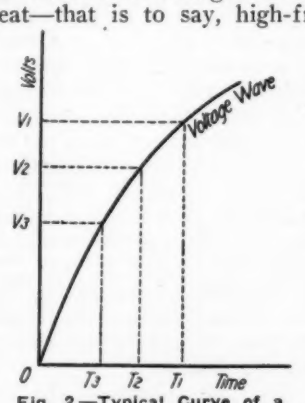


Fig. 2.—Typical Curve of a High-Voltage Wave and Comparison of Horn Gap, Sphere Gap and Impulse Gap.

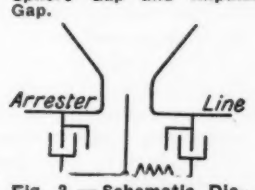


Fig. 3.—Schematic Diagram of Impulse Gap.

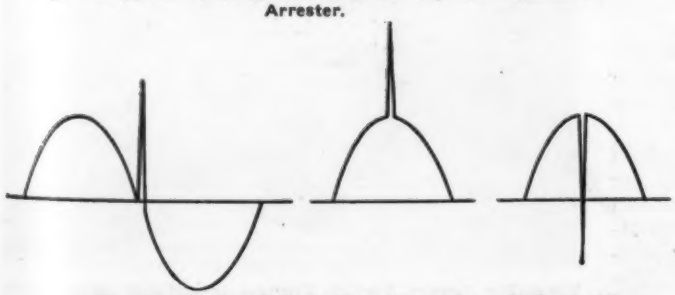


Fig. 4.—Impulse Voltage Superimposed on 60-Cycle Wave.

Fig. 2 illustrates this graphically. V_2T_2 represents the point and time of breakdown of a properly designed sphere gap which has no time to lag. V_1T_1 shows the delay resulting from the time lag of an ordinary horn gap and the consequent greater rise of voltage be-

fore the discharge takes place. V_2T_2, on the other hand, shows the earlier discharge and the quicker and better protection resulting from the lower-voltage breakdown of the impulse gap due to its selectivity.

The impulse gap uses a circuit (see Fig. 3) that, at normal frequency, is balanced as to voltage, but becomes unbalanced and starts a discharge in the case of any high-frequency surge. At normal frequency there is no difference of potential between the midpoint of the condensers and the auxiliary electrode midway between the auxiliary horn and sphere gap. A high frequency, however, passes freely through the condensers and piles up its full voltage across the resistance—that is, across one-half of the total gap. This gap, therefore, breaks down, resulting in the total voltage being impressed on the remaining gap, which breaks down in turn, dissipating the disturbance to ground. The breakdown of each half of the gap is facilitated by the fact that the auxiliary electrode is small in size (having needle-gap characteristics) so that the discharge voltage of each half of the gap is about one-quarter, rather than one-half, of that of the total gap between the spheres.

It should be especially noted that the danger to apparatus from steep-wave-front surges, particularly of reverse potential, may be out of proportion to their actual magnitude, due to the inductance of apparatus, which not only produces a high voltage across the first few turns of the winding of any apparatus, but also a much higher voltage to ground than the normal voltage of the impulse, due to the addition of induced or reflected voltage to the normal voltage of the impulse. If the apparatus is to be protected with a gap and lightning arrester, the gap should be one that will select and discharge the high-frequency disturbances at a voltage lower than the normal voltage of the gap. The impulse gap accomplishes the desired result.

The necessity for selective action in the gap is emphasized by the following possible combinations (see Fig. 4) of the impulse and line voltage. (Assume that an ordinary sphere gap to ground is set to discharge at twice the line voltage.)

Case A.—The voltage of the line does not affect the action of the impulse, and the impulse must reach twice the line voltage before the gap protecting the apparatus will discharge.

Case B.—The voltage of the impulse must reach only the same voltage as that of the line, before the gap discharges.

Case C.—The voltage must have a value three times the line voltage before the gap discharges. In this case, it is to be noted that conditions are such that the high-voltage stress is present not only to ground, but also between turns of windings of apparatus. Adequate protection against this condition demands the use of a gap which is very sensitive to steep-wave-front surges. If the impulse is oscillating, the second half cycle may cause a discharge, but the time for protection against the destructive effect of the first half cycle will have passed.

It is to be noted that with the impulse gap, the discharge begins at a lower voltage than with a sphere gap, and hence operates more quickly than a sphere gap.

The impulse gap consists of standard (Faradoid and pillar) porcelain insulators (two of which are used as condensers), an unbalancing resistor, an auxiliary electrode or tickler, a sphere gap, an auxiliary horn gap, a short-circuiting clip, a charge-and-discharge resistor, and a supporting framework. The framework is equipped with feet which can be mounted upon an existing structure if the purchaser supplies inverted feet or other standard pipe connections and fittings.

NEW TYPE OF ELECTRIC FURNACE IS USED IN SEATTLE STEEL FOUNDRIES.

Composition of Slag for Absorbing the Iron Oxide and the Prevention of Blowholes in Castings.

The Greene Electric Furnace Co. is being incorporated at Seattle to build, sell and install the type of furnace controlled by the Greene Process Metal Co. of St. Louis. This furnace, designed and patented by Albert E. Greene, is the rolling cylinder, arc type, a number of which are in use in the steel foundries of Seattle and other cities of the Northwest. The 3-ton furnace installed in the plant of the Olympic Steel Works, Seattle, has two 5-in. graphite electrodes, requiring from 500 to 600 kw., 2-phase, at a voltage of 100 to 110. The 3-ton charge of scrap steel is melted in 2 to 3 hours, this being deoxidized by means of the Greene slag process in which a patented composition of sand and clay, or lime, is used to give the required fluidity. This slag absorbs the oxide of iron carried in the bath on the scrap, eliminating it from the bath below. The oxide of iron thus dissolved in the slag is reduced by throwing upon it finely powdered coke, ferro-silicon, or other reducing agent, resulting in the return to the bath of the iron formerly in the oxidized state. This elimination of the dissolved oxide from the molten mass obviates imperfect castings produced by blow-holes, which are caused by the presence of iron oxide.

The company's newest type of 3-ton furnace has three electrodes, for 3-phase current, and is equipped with a 400-kv-a. transformer.

Among other installations of this type made in Washington is a 2-ton single furnace in the new Aurora foundry, Seattle; a 1½-ton furnace at the plant of the Pacific Car & Foundry Co., at Renton; and furnaces of smaller capacity at Everett and Olympia. The first installation of a Greene electric furnace made in the Middle West was in the works of the Dayton Malleable Iron Works, Dayton, Ohio.

The accompanying illustration shows a Greene 3-ton electric furnace at the Olympic Steel Works, Seattle. The rolling mechanism affords easy control in tilting. The shell in this furnace is made of ¾-in. steel plate.

Three-Ton Greene Electric Furnace in Olympic Steel Works, Seattle, Wash.

Trade Activities

Cutler-Hammer Manufacturing Holds Sales Conference—Manufacturers' Representatives Appointed — Literature

France Manufacturing Co., of Cleveland, Ohio, maker of F-F battery boosters, announces the appointment of Champion & Ryan, 299 Broadway, New York City, as its exclusive factory representative in New York City, Boston, Philadelphia and adjacent territory.

The Hallidie Machinery Co., Seattle, Wash., sales agent for the Jones underfeed stokers, has installed stokers of this type under Stirling boilers in the plant of the Rainier Heat & Power Co., at Seattle; and Dutch ovens have also been put in for facilitating the use of hog fuel to be fed from the top. Similar stokers have been installed by the Hallidie company in the power plant at the coal mine of the Northwestern Improvement Co., at Roslyn, Wash., in which Washington lignite is used.

Despard & Gordon Co., Chicago, has put out a descriptive booklet of its new "Levolier" socket. This socket, the first practical 660-watt pull socket on the market, is designed to carry the extra load required by the large number of high-wattage electrical devices now in use. Another feature of this socket is that it can be used either with or without the chain. Without the chain it can be operated in any direction with a slight pressure of the thumb. The cost of this socket, which is rated at 660 watts, 250 volts, is claimed to be but little more than the regular 250-watt socket.

Hamilton-Beach Manufacturing Co., Racine, Wis., anticipating what will probably be the biggest practical Christmas in our history, has organized a national advertising campaign featuring the H-B home motor. This little motor is designed for use in the home and is equipped with a number of attachments which permit its use in a large number of places about the home. The more prominent ways in which it can be used when equipped with the proper attachment are: Sewing, whipping cream, beating eggs, sharpening knives, and polishing silver. In addition an attachment is furnished which enables the motor to be used as a fan in summer. The advertising plan spoken of consists of a number of large insertions in some of the leading magazines to which will be added a local campaign to be carried on by the dealers. For this latter part, mats and electrodes of the larger advertisements have been prepared which are available to the dealer for use in the local papers.

Cutler-Hammer Manufacturing Co., of Milwaukee, Wis., is distributing a four-page descriptive pamphlet entitled "Miscellaneous Applications of Electrical Heat by Means of Standardized Units." These standardized heating units are known as C-H space heaters. They are about the same size as 2 ft. of lath. The blueprint which accompanies the new pamphlet gives all the dimensions of these standardized units. The pamphlet makes special mention of the great variety of applications of these units, important among them are: Crane and hoist cabs, meter houses, watchman houses, detached or exposed rooms, storage house offices, freight house offices, temporary construction offices, valve houses, sprinkler riser houses, mines, where explosives are present, where open flame would be dangerous, for keeping oils free to flow, drying rewound motor armatures, for able men and shear men in steel plants, for keeping automobile and motor truck engines warm. These space heaters are so easily installed and lend themselves so readily to heating small enclosures and out-of-the-way places, industrial plants are finding new uses for them every day, reference being made to the fact that one plant put 2000 in use last year. The pamphlet shows numerous suggestions for installing the space heaters in such small rooms as those used for oil storage, varnish drying, crane cabs, watchmen's towers, as well as methods of making an improvised room-heater or foot-warmer. In order that these space heater units may be easily kept in stock and identified when wanted, they are packed in labeled boxes of 10 each. The pamphlet further gives the code number of the various voltages for which these space heaters are made as well as price, and weight of standard package.

Roller-Smith Co., 233 Broadway, New York City, announces the appointment of W. A. McCombs & Co., Union Arcade building, Pittsburgh, Pa., as its agent in the state of Pennsylvania west of Altoona and the entire state of West Virginia. W. A. McCombs & Co. will handle the Roller-Smith Co.'s lines of instruments, circuit breakers and meters in this territory.

Davis Sewing Machine Co., Dayton, Ohio, has recently issued a folder for use by dealers which describes very clearly the many features of the Davis portable electrical sewing machine. In the folder considerable emphasis is laid upon the portable feature of this machine and at the same time many other features such as the ease of control and the speed at which it can be operated are brought out.

Victoria Electric Supply Co., jobber of electrical supplies and fixture parts, announces its removal from 157 King street, West, Toronto, to the ground and first floors of the Nordheimer building, 77 York street. The new premises are very commodious and will admit of the more expeditious shipment of goods and also will enable the company to carry a more extensive stock of supplies.

George H. Gibson Co., Tribune building, New York City, announces the appointment of M. William Ehrlich on its staff. Mr. Ehrlich has just completed 10 months' war service at the U. S. Government explosives plant, at Nitro, W. Va., as an engineer on progress for the Thompson-Starrett Co. The Gibson company is an organization of engineering and editorial specialists engaged in the commercial development of mechanical businesses and their products.

Cutler-Hammer Manufacturing Co., during the week ending Dec. 7, held a five-day sales conference in Milwaukee for the benefit of its men who direct the district office sales of wiring devices, push button specialties, and molded insulation. The conference was in charge of W. C. Stevens, sales manager, A. H. Fleet, manager of the wiring devices department, and Ed. Karl. New devices, methods of manufacturing wiring devices and molded insulation products, advertising and selling plans with special reference to increased sales during the reconstruction period, were some of the important subjects taken up. The wiring device salesmen in the various district offices were represented by M. F. Coyne, Boston; F. J. Walker, New York; G. W. Donkin, Pittsburgh; C. N. Gilmore, Cleveland, and Z. S. Myers, Chicago.

V. V. Fittings Co., Philadelphia, recently distributed Catalog No. 21, listing its complete line of fittings and equipment. No expense has been spared in making this book the best it has thus far issued, and the company is to be congratulated on the appearance and makeup of this splendid publication, which is one of the most handsome catalogs issued this season. Its contents are printed on heavy enameled stock and is a fine example of the printing art. In compiling this catalog, special care has been taken to list the products in such a way that they may be quickly and easily located. The extensive character of this line, comprising as it does a complete line of conduit fittings adapted to the different types of apparatus made by manufacturers, makes this feature especially valuable. In addition to conduit fittings, this line also includes vapor-proof globes, lamp guards, reflector holders, safety switches, etc. In fact, practically everything needed in wiring a building except the wire and fixtures is listed in this catalog of 128 pages. The first 12 pages are devoted to a pictorial index of the contents. The method, undoubtedly the best for listing such material, enables the purchaser to quickly locate any product without knowing the trade-name of that article. In addition to this index, the catalog also contains an alphabetical and numerical catalog number index, which is for reference only and is inserted for convenience in checking invoices. Several interesting tables of general information are also included.

Current News

Weekly Record of Construction Activities—Conventions

EASTERN STATES.

CHATHAM, MASS.—The United States Government, Navy Department, has taken bids for the erection of the proposed boiler plant at the local station. The structure is estimated to cost $45,000.

CHELSEA, MASS. — The United States Government, Bureau of Yards and Docks, has awarded a contract to J. P. Dwyer Co., 183 Harrison street, Boston, for the installation of a new heating system at the local Government station.

HOPEWELL, CONN. — New York, New Haven & Hartford Railroad has completed plans for the erection of a one-story engine plant, about 70x106 ft., at its local properties. The structure is estimated to cost $50,000.

NEW LONDON, CONN. — The United States Government, Bureau of Yards and Docks, has awarded a contract to Miles & Sons Co., 393 Main street, Worcester, Mass., for the construction of the proposed one-story subcharging stations, about 24x57 ft. and 24x87 ft. in size.

BINGHAMTON, N. Y. — Because the Binghamton Light, Heat & Power Co. had failed to comply with requirements of the Board of Contract published when bids for street lighting were requested, and had failed to file a certified check covering 5% of the amount of the bid, all bids were rejected by the Board of Contract and Supply, and the secretary was directed to readvertise. Proposals were again opened Dec. 11 on proposals to light the city streets for terms ranging from one to five years inclusive. The new specifications require deductions for outrages not covered in the last proposal, it is announced.

BROOKLYN, N. Y. — The United States Government, Navy Department, has awarded a contract to the Lustbader Construction Co., 103 Park avenue, New York, for the erection of an electrical and machine shop at the local navy yards.

BUFFALO, N. Y. — Worthington Pump & Machinery Corporation has completed arrangements for alterations and improvements in the transformer station and administration building at its Snow Holly Works, Clinton and Roberts streets.

MOUNT KISCO, N. Y. — Fire, on Nov. 30 caused a damage of $150,000 and completely destroyed the local telephone exchange building. It is understood that the structure will be rebuilt at once.

NEW YORK, N. Y.—Red Top Electric Co. has filed notice of an increase in its capitalization from $500,000 to $575,000, to provide for business extensions.

NEW YORK, N. Y.—Plans are being prepared for alterations and improvements in the plant of the Lion Brewing Co., estimated to cost, with equipment, approximately $200,000. It is proposed to convert the works into an ice manufacturing plant, and considerable electrically-operated machinery will be installed.

NEW YORK, N. Y. — American Radio Co., radio and electric specialties, has increased its capital from $10,000 to $2,000,000.

NEW YORK, N. Y. — The Public Service Commission is conferring with the Board of Estimate relative to the immediate continuance of work on the New York subway system, asking an appropriation of $26,500,000 to provide for new contracts. It is estimated that work aggregating about $60,000,000 can be completed during the coming year, or more than one-half of the total. The new work will include the Queensboro subway extension from Park avenue to Times Square, the Westchester Avenue elevated extension of the Lexington Avenue subway to Hunterspoint station, the Nassau Street subway, and other branches, to include additional power plant capacity, substations, and other electrical features of operation.

ONEIDA, N. Y.—Adirondack Electric Power Corporation which operates in this city has filed with the Public Service Commission a petition asking for approval of the plan to operate a high tension electric power line between its substation at Amsterdam and another station between Little Falls and Herkimer.

RICHMONDVILLE, N. Y. — A bond issue of $5000 is necessary to complete electric light now under construction.

ROME, N. Y. — Rome Gas, Electric Light & Power Company, 139 North James street, has recently commenced the construction of a one-story transformer building at its plant, about 20x25 ft. in size. A. B. Morton is superintendent.

SCHENECTADY, N. Y. — General Electric Co. has completed arrangements for the erection of a three-story addition to its building No. 20, about 36x75 ft., estimated to cost $35,000. Jacob & Young, 711 Brandywine avenue, are the contractors.

SYRACUSE, N. Y. — In connection with the budget approved by the Board of Supervisors for the operation of the Onondaga Tuberculosis Sanitarium, the sum of about $31,408 has been appropriated for improvements in the power plant at the institution and the installation of a new underground pipe line.

SYRACUSE, N. Y.—Seneca River Power Co. has filed notice with the Public Service Commission of an increase in its capital stock from $50,000 to $100,000, to provide for expansion.

BAYONNE, N. J. — Owing to the cancellation of Government contracts, the Babcock & Wilcox Co. is reducing its working force, and will engage as heretofore, in the manufacture of boilers for private use. The company was awarded a large contract for the manufacture of boilers for warships, as well as merchant marine.

ELIZABETH, N. J.—Elizabethtown Water Co., 68 Broad street, is considering preliminary plans for the erection of a pumping plant and filtration works, one and two-story, at Milltown, to have a capacity of 20,000,000 gallons. The work is estimated to cost $150,000.

GLOUCESTER CITY, N. J.—Emergency Fleet Corporation is making rapid progress on the construction of the new branch traction system to be operated from Broadway and Warren street to Yorkship Village, the site of the new housing development for workers at the plant of the New York Shipbuilding Corporation.

MORRISTOWN, N. J.—Morris & Somerset Electric Company has acquired the plant of the Boonton Electric Co., Boonton, including water rights along the Rockaway river. It is understood that the new owner is planning for extensive development for power purposes.

NEWARK, N. J.—The City Commission has revoked its contract with the Public Lighting Service Corporation, 38 Murray street, New York, for maintaining a total of 2000 street lamps in various sections of the city, for failure, it is understood, to provide proper illumination.

NEWARK, N. J.—M. V. Engineering Company has filed notice of authorization to operate at 56 Summer avenue for the manufacture of electrical specialties. Alfred Minnich, 382 Summer avenue, and Earl Hinman, 46 Park street, head the company.

NUTLEY, N. J.—The Town Commission has had plans prepared for the installation of new lighting units of increased candlepower for the street-lighting system. The Public Service Electric Co. supplies energy for operation.

PERTH AMBOY, N. J.—The Board of Aldermen, Water Board, has awarded a contract for the construction of a new pumping station at South river, the structure estimated to cost $14,850.

ERIE, PA.—In connection with the controversy of the Erie County Lighting Co. with its electrical linemen, for an increase in wages, the National War Labor Board has granted these employes an increase to 70 cents per hour, retroactive to June 25, 1918.

ERIE, PA.—Electric Materials Co.

has completed arrangements for the construction of the proposed addition to its plant, to cost about $5000.

HARRISBURG, PA. — The city is considering plans for extensions in the underground conduits for the police and fire alarm systems, to connect North Court, Briggs, and Cowden streets.

PHILADELPHIA, Pa.—Pennsylvania Railroad, Broad Street Station, has had plans prepared for the erection of a new addition to its power house at Butler street and Glenwood avenue. The structure will be one-story, about 18x40 ft., and is estimated to cost $5000.

PHILADELPHIA, Pa. — Philadelphia Electric Co. has made announcement that all restrictions concerning the use of electric light and power have been removed and normal service resumed. It is requested by the company, however, that customers voluntarily use as little electricity as possible during the month of December, between the hours of 4 and 7 p. m. Joseph B. McCall is president.

PHILADELPHIA, PA. — In connection with the proposed improvements at the local navy yards, the Naval Affairs Committee of the House of Representatives, Washington, D. C., has increased the proposed appropriations for the work. Included in the budget is the sum of $1,500,000 for the completion of the new dry dock, to provide for electrical shops, and other shop structures, $400,000 for the erection of a new pipe and copper shop, and other amounts.

PHILADELPHIA, PA. — Lewis & Roth Corporation, Broad and Chestnut streets, manufacturer of electrical apparatus, has filed notice of an increase in its capital from $5000 to $233,000.

PITTSBURGH, PA. — American Bridge Co. has acquired a large tract of land comprising about 120 acres at Floreffe Station, near West Elizabeth, having a frontage of 3000 ft. on the Monongahela division of the Pennsylvania Railroad, to be used, it is understood, as a site for the construction of a large new plant.

PITTSBURGH, PA. — Duquesne Light Co., 435 Sixth avenue, has postponed indefinitely the construction of the proposed addition to its power station of Brunots Island, near Pittsburgh.

READING, PA. — Carpenter Steel Co. has awarded a contract for the construction of a new steam power plant at its works, one-story about 60x180 ft., estimated to cost $110,000. The Beard Construction Co., 658 Penn street, Reading, is the contractor.

SAYRE, PA.—Sayre Electric Co. is making rapid progress on the installation of new boiler equipment at its plant, to provide for increased capacity. The company has recently placed into effect increased rates for service.

SHENANDOAH, PA.—Fire on Dec. 1 destroyed the boiler plant at the works of the Kehley Runn Colliery. It is understood the structure will be replaced at once.

SHIRE OAKS, PA.—The Pennsylvania Railroad has awarded a contract to Irwin & Leighton, 126 North 12th street, Philadelphia, for the erection of a new extension to the local engine house, to cost about $100,000.

DATES AHEAD.

Florida Engineering Society. Annual meeting, Jacksonville, Jan. 5, 1919. Secretary, J. R. Benton, Gainesville, Fla.

American Institute of Consulting Engineers, Inc. Annual meeting, New York City, Jan. 13, 1919. Deputy secretary, B. Etchelle, 35 Nassau street, New York City.

Northern White Cedar Association. Annual meeting, Milwaukee, Wis., Jan. 21, 1919. Secretary, N. E. Boucher, 702 Lumber Exchange, Minneapolis, Minn.

Western Association of Electrical Inspectors. Annual meeting, Chicago, Ill., Jan. 28-30, 1919. Secretary, W. S. Boyd, 175 West Jackson boulevard, Chicago, Ill.

Oklahoma Utilities Association. Annual meeting, Oklahoma City, Okla., Feb. 13, 14 and 15. Secretary, H. A. Lane, Oklahoma City, Okla.

New Mexico Electrical Association. Annual meeting, Albuquerque, N. Mex., Feb. 17-19. Secretary-treasurer, Charles E. Twogood, Albuquerque, N. Mex.

STATE COLLEGE, PA. — Fire destroyed the Pennsylvania State College engineering school building and equipment with a loss of more than $300,000. The heat, power and light plant of the college was put out of commission so that virtually every activity of the institution will be at a standstill for an indefinite period. Address President Sparks.

WILMINGTON, DEL. — Jessup & Moore, Commercial Trust building, Philadelphia, Pa., have had plans prepared for the erection of a one-story addition to the boiler plant at their local works.

WASHINGTON, D. C. — Washington Railway & Electric Co. has disposed of its bond issue of $1,000,000.

HAMPTON ROADS, VA. — Plans have been prepared by the Government for the installation of a new extension to the local pneumatic tube system, estimated to cost about $3000 and a new fire alarm system, to cost about $6000. The Navy Department has awarded a contract for the installation of new turbogenerators at the local navy yards. The work is estimated to cost $119,000.

NORFOLK, VA.—The United States Government, Navy Department, has awarded a contract to Harry Alexander, Inc., 20 West 34th street, New York, for the installation of an electric light and power system in the local steel-forge building, at $9700.

WEBSTER SPRINGS, W. VA.—Webster Springs Water & Electric Light Co. is considering the installation of a new electric light plant.

ATLANTA, GA. — Georgia Railway & Power Co. will improve the sub station. Boulevard station capacity of Lindale line transformer will be increased to 6000 kv-a. by installation of two banks of three 1000 kv-a. transformers each, with extra transformers for each bank. Extra transformers will be installed at Newnan substation.

SARASOTA, FLA. — The city is planning a bond issue for $80,000, to provide for the acquirement of the plant of the Sarasota Ice & Electric Co. It is understood that the plant will be enlarged and the capacity increased.

NORTH CENTRAL STATES.

DURAND, ILL. — An application for a certificate of convenience to operate an electric light and power utility, serving Durand, Davis, Rock City and Dakota in Winnebago and Stephenson counties was filed with the public utilities commission by the Citizens' Utilities Co. of Durand. Authorized to issue $40,000 of common capital stock and to purchase utility plants at Durand, Dakota and Davis is sought. Address J. F. Harris.

LINCOLN, ILL. — Lincoln Telephone Co. has reorganized with an increased capitalization totaling $300,000. The Central Illinois Telephone & Telegraph Co., the Elkhart Independent Telephone Co. and the New Holland Telephone Co. are included in the incorporation.

GALESVILLE, WIS.—Davis Mill Co. will build an addition to its power house. A 100-hp. engine will be installed. Ben W. Davis, manager of the Davis Mill Co.

RHINELANDER, WIS. — Robbins Lumber Co. is considering building an addition to its plant. The specifications include electric generating equipment and woodworking machinery. F. S. Robbins, president.

SHEBOYGAN, WIS.—Capt. Ernest Gonzenbach has purchased property of Falls Roller Mills, Sheboygan Falls, and is planning to enlarge the plant and install additional hydroelectric equipment.

MAQUOKETA, IA. — Election to vote $65,000 bonds for electrical improvements carried.

HUMANSVILLE, MO. — Humansville Electric Light Co. will construct an electric transmission system from Caplinger Mills to Stockton, a distance of 8 miles. L. L. Mathis, secretary.

KENNETT, MO.—C. C. Parsons, manager of the local electric light plant, has just returned from a meeting of the 28 local managers of the Arkansas Electric Light & Power Co., which was held at Pine Bluff, Ark. The meeting was held in order that the managers of the different plants might exchange ideas with a view to establishing a more uniform and better electric light and power service.

SCHELL CITY, MO. — Schell City Light Co. will construct an electric transmission system to Harwood, a distance of 6 miles.

SUMNER, MO. — Sumner Electric Co will construct an electric transmission system to Forker.

WAVERLY, MO. — Waverly Electric Co. will install a duplicate generating unit for emergency purposes. The present equipment includes 20 kv-a. three-phase generator and 25 hp. gas engine

OCONTO, NEB.—Dr. J. L. Paine is planning to erect additional transmission lines in the residence section.

ASHLEY, N. DAK.—Ashley Electric Co. is planning to install a 200-hp. Corliss engine. S. P. Waags, manager.

SOUTH CENTRAL STATES.

DANVILLE, KY. — L. B. Herrington, Richmond, and associates, are said to be planning for the operation of a new hydroelectric plant on the Dix river, near Danville, including the erection of a large dam about 100 ft. high, for the generation and distribution of electric energy. It is said the project is estimated to cost in excess of $3,000,000.

GREENUP, KY. — The city is considering plans for the reconstruction of its electric light plant recently destroyed by fire.

ANNISTON, ALA. — Woodstock Operating Corporation is said to be considering plans for the installation of a quantity of new generating equipment and new electrically-operated lifting magnets.

SHEFFIELD, ALA.—Southern Bell Telephone & Telegraph Co. will spend $35,000 in the construction of a new telephone office at Sheffield.

BAY SPRINGS, MISS. — Bay Springs Electric Light Co. will repair its plant damaged by fire and will install a new dynamo. O. E. Ford, manager.

TUTWILER, MISS.—Election to vote bonds for installing an electric light plant is contemplated.

COTTER, ARK.—Dixie Power Co. will establish a hydroelectric plant at a total cost of $5,000,000. Work will consist of constructing a dam 2000 ft. long and 150 ft. high across White river. Procedure now awaiting approval of the War Industries Board.

NEW ORLEANS, LA. — New Orleans Boiler Works are planning for extensions to their plant to increase the present capacity, including the installation of a quantity of new equipment.

OIL CITY, LA.—Oil City Electric Light & Power Co. will erect an addition to its plant to supply additional light and power to the towns of Oil City and Mooringsport.

OKMULGEE, OKLA.—Building operations, involving the expenditure of more than a half million dollars, are to be begun in Okmulgee as soon as material and labor can be secured. Extensive enlargements and alterations to the electric, ice and light plants are contemplated at a cost estimated at $150,000.

SULPHUR, OKLA. — The city is considering the erection of a power house at the pumping station. Address mayor.

TULSA, OKLA.—Cicero L. Holland and M. J. Glass, 219 A. S. Main street, are interested in the installation of a hydroelectric power plant on the Arkansas river, capable of furnishing cheap illumination and fuel to a city of 250,000 people, which can be built for $2,000,000.

BURKBURNETT, TEX. — Central Power & Service Co. is considering the erection of a new steam-operated power plant.

DALLAS, TEX.—City Commissioners have approved a contract between the Dallas Power & Light Co. and the Texas Power & Light Co. for electric current to be furnished users at Monroe station, or Trinity Heights as it is more commonly called. The contract will give electric current to Trinity Heights at only one-half cent per kw. hr. more than the city of Dallas is paying.

DALLAS, TEX.—Dallas Power & Light Co. has been granted permission to purchase the Carroll Electric Co., a small local plant for $5000. With this plant the company can make connections which will increase the rate of return and eventually will result in further reductions in rates to users of electricity.

ORANGE, TEX.—National Shipbuilding Co. has the work well under way of constructing a modern power plant that is to be operated independently in furnishing power for the company's entire shipyard.

WESTERN STATES.

BUTTE, MONT.—Mountain States Telephone & Telegraph Co. will invest $90,000 in extensions in South Butte. J. C. Ownes, district manager.

HARDIN, MONT.—Pacific Telephone & Telegraph Co. will install a new set of poles for its telegraph system. Gerald Lansing, local manager.

CARLSBAD, N. M. — The power plant of the Carlsbad Water & Light Co. burned. Loss $10,000. The plant will be rebuilt.

KELLOGG, IDA. — Bunker Hill & Sullivan M. & C. Co. is remodeling the old Sweeney concentrating mill for retreating the heavy tonnage of tailings that have accumulated in the last 20 years. The mill has the capacity of 500 tons per day. The new equipment is understood to include motors for electric drive.

WALLACE, IDA.—Anchor Mining Co. will install an air compressor to be electrically driven.

RAYMOND, WASH. — Citizens of Willapa, Wash.. have petitioned the Willapa Electric Co. to establish an automobile service between that town and Raymond and as soon as practicable to extend its electric railway line to Willapa. J. R. Sniden, manager of the electric company, has the matter under consideration.

CENTRALIA, WASH.—Work will soon be commenced on a line connecting property of Central Light & Manufacturing Co. at Pe Ell with the North Coast Power Co. lines at Meskill.

LOS ANGELES, CAL.—In connection with the new service building to be erected at the site of the tubercular hospital at Sylmar, considerable new electrical equipment will be required.

JUNEAU, ALASKA.—Chicago Mining Co. is considering plans for the erection of a new power plant at its properties for operation.

FOREIGN.

MONTREAL, QUE.—Fire recently damaged the boiler plant and a portion of the works of the Patterson Manufacturing Co., St. Hubert street, with a loss estimated at $10,000.

TURBINE, ONT. — Fraser Brace Co., Montreal, has been awarded the general contract for power development, costing $2,000,000, for the International Nickel Co., Copper Cliff, Ont.

PROPOSALS

ALTERATIONS IN CONDUIT AND WIRING.—Bids will be received Dec. 19 for alterations in conduit and wiring and lighting fixtures in the United States Custom House, St. Paul, Minn. Plans with supervising architect, Treasury Department, Washington, D. C.

WIRE, CABLE, ETC.—Sealed proposals will be received by the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., and firms desiring to submit bids should give schedule numbers for furnishing the following: Schedule 3526, fuse wire, bare nickel-steel resistance wire, and resistance ribbon wire; schedule 3527, flexible brush-holder cable, single-conductor ignition cable, and searchlight cable; schedule 3528, silk-covered magnet wire; schedule 3534, ship-lighting cable, telephone cable, annunciator wire, lighting and power wire, rubber-covered wire, telephone wire, weatherproof wire, lead-sheathed cable, and lighting and power cable.

INCORPORATIONS

NEW YORK, N. Y.—Radio Lamp Corporation. Nominal capital, $5,000. To manufacture electrical specialties. Incorporators: A. B. Simonds, W. Burckhardt, and G. E. Ruppert, 5 West 86th street.

NEW YORK, N. Y.—Electrol System, Inc. Nominal capital, $5,000. To engage in a general electrical contracting capacity. Incorporators: C. W. Diffin, A. Johns, and R. U. Conger, 52 Vanderbilt Avenue.

LITTLE FALLS, N. Y. — Franklin County Power Co. Capital, $60,000. To operate a local electrical distribution system. Incorporators: H. S. Lavery, A. H. McCann, and P. S. McCaghey, Little Falls.

ROCHESTER, N. Y.—Ratiometer Corporation. Capital, $25,000. To manufacture boilers, motors, engines, meters, and other equipment. Incorporators: L. P. Willsea, I. Lundgaard, and W. K. Smith, 818 Dewey avenue, Rochester.

PHILADELPHIA, PA. — Somerset Electrical Co. Capital, $10,000. To manufacture electrical specialties. Roy L. Crover is the principal incorporator.

EASTON, PA. — Schweyer Electric & Manufacturing Co. Capital, $100,000. To manufacture electrical specialties, etc. Alvin H. Butz, Allentown, is treasurer.

TRENTON, N. J. — Hutchinson Storage Battery Co. To take over the plant of the Hutchinson Storage Battery Company located at 230 South Warren street. Incorporators: Roy Skelly, John E. Hutchinson, and Herbert F. Backes, Trenton.

STRONGHURST, ILL. — Stronghurst Telephone Co. has incorporated with a capital of $30,000 by Thomas Dixon, C. R. A. Marshall and Grover Rebling.

Recent Patents

Selected and Summarized by Albert Scheible, Patent Attorney, 79 West Monroe Street, Chicago, Illinois

A series of brief comments on some of the recently issued electrical patents which appear to be of particular interest to our readers, the number after each heading being that of the United States patent to which the summary relates. Any correspondence regarding such patent matters should be sent direct to Mr. Scheible at the above address.

Flash Lamp With Extension (1,282,555).—In the flash-lamp patented by William A. Erickson (of Brooklyn) the battery is connected to the lamp by a flexible cord. This cord may be coiled inside the casing into which the lamp and battery can be inserted, the lens being mounted on this casing.

Lamp-Shade Holder (1,282,593).—To shield the eyes from the direct

No. 1,282,593.—Lamp Shade Holder.

rays of an incandescent lamp, Max Kossman (of Brooklyn, N. Y.) supports a substantially hemispherical reflector by means of wire loops which clamp the bulb of the lamp between them.

Float-Controlled Circuit Closer (1,282,178).—An electric alarm controlled by a float in the drip pan under an ice box is shown in this patent to Wilfrid J. Bonsquet, of Woonsocket, R. I.

Storage Battery Electrode (1,282,159).—A peculiarly grooved and otherwise recessed grid for storage batteries is shown in this patent, assigned by James A. Wood (of Philadelphia) to the Automatic Electric Equipment Co. of the same city.

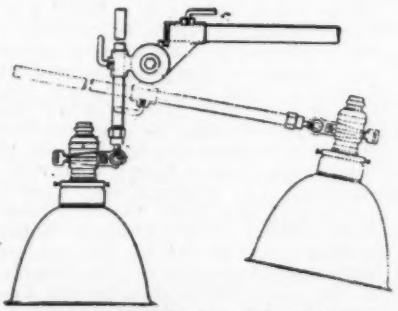
Electric Starter (1,282,172).—The electric starter designed for automobile engine and the like by John A. Beirns (of Detroit) includes a planetary eccentric gearing, and an eccentric mounted on the starter shaft. This gearing is adapted to be actuated by the eccentric.

Fuse Plugs (1,282,566 and 1,282,567).—The first of these two patents, both assigned by Henry F. Goetz to the Waterbury Mfg. Co. (of Waterbury, Conn.) discloses a novel method of arranging sheet metal contacts for the terminals of the fuse. The other patents relate to a cheap method of making prong-shaped contacts for the center terminals of such plugs.

Driving Graphic Recorders (1,282,664).—For graphic recording instruments, Otis White (of Springfield, Ill.) provides a spring-driven mechanism mounted as a unit. This includes worm gearing arranged for controlling the speed of the transmission between the spring-operated motor and the instrument which is to be driven. The patent was assigned to the Sangamo Electric Co., also of Springfield, Ill.

Graphic Meter (1,282,621).—This recording meter has a dial rotated by clockwork and has a time controlled mechanism for periodically feeding ink from a reservoir to a pen. Patented by John A. Obermaier of Chicago.

Lamp-Support (1,282,676).—Swiveling arrangements for supporting a lamp socket so that it can be adjusted through a wide range of positions are



No. 1,282,676.—Lamp Support.

shown in this patent to William J. Carlin of Roxbury, Mass.

Amplifying Variable Currents (1,282,439).—A condenser and high-resistance shunt arrangement, to be used in connection with an electron-emitting cathode, is described in this patent to Irving Langmuir of Schenectady. (Patent assigned to the General Electric Co.)

Electric Air-Heater (1,282,208).—According to this patent, assigned to the American Electrical Heater Co. by Frank Kuhn and Jay A. Hand (all of Detroit, Mich.) brackets support a frame which has end heads. The heating units are detachably mounted in the frame and have heads which slidably engage those of the frame.

Making Ductile Tungsten (1,282,122).—Tungsten powder is compressed to the critical point at which it can absorb no more mechanical energy, or to a density greater than 15.5, and then fused. The patent was assigned by Carl A. Pfanstiehl to the Pfanstiehl Co., Inc., of North Chicago, Ill.

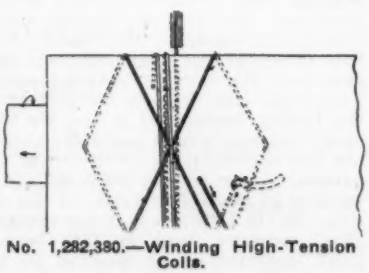
Electric Irons (1,282,038 to 1,282,040).—These three patents to George Bullock and Arthur E. Templeman (both of Grand Junction, Colo.) all relate to arms extending upward from the handle of the flatiron and carrying the cord to support the latter out of the operator's way.

Electrode Holder for Searchlights (1,282,133).—To cool the electrode holder, Elmer A. Sperry (of Brooklyn, N. Y.) feeds this through a refractory sleeve which has heat-radiating ribs on it. This sleeve is housed in a casing through which air is forced by a blower, the blower being driven by the same motor which feeds the electrode.

Fuse Cartridge (1,282,606).—To provide a fuse cartridge which will be refillable, Herbert Lutz (of Hamilton, Ontario) slips two caps over the ends of the cartridge casing. Each of these caps carries a binding post for making the connections to both the fuse strip and one of the terminal clips of the fuse.

Illuminating Appliance (1,282,617).—Under this title Otis A. Mygatt (of New York City) has patented a light diffusing appliance comprising two bowls, one within the other and separated by an air space. These bowls have prisms all running in the same direction and so calculated as to direct most of the light downwardly. The patent, issued on an application filed in 1915, was assigned to the Holophane Glass Co.

Winding High Tension Coils (1,282,380).—To form a secondary winding for high tension coils, Frederick W. Cotterman (of Dayton, Ohio) applies threads of insulation in a continuous band-like formation of "figure



No. 1,282,380.—Winding High-Tension Coils.

eights" spirally wound from one end of the coil to the other, and at the same time applies a layer of wire between the edges of the band. The patent was assigned to the Splitdorf Electrical Co. of Newark, N. J.

Personal

L. E. Schumacher Becomes Works Manager of Krantz Manufacturing—J. K. Mahaffey Made District Sales Manager

C. C. CASH has been appointed auditor of the Port Clinton Electric Light & Power Co., Port Clinton, Ohio, succeeding E. H. Rechberger.

CHARLES EDISON, of Thomas A. Edison, Inc., West Orange, N. J., has been appointed a member of a permanent committee to provide a welcome for homecoming soldiers. The committee will also look after the men generally and see that a suitable position is secured.

HUGH J. PRITCHARD, New York, has been appointed president of the National Conduit & Cable Co., to succeed George J. Jackson, deceased. G. H. Hawley, formerly with the Ansonia Brass & Copper Co., has been elected a vice-president of the company in charge of manufacture.

BERTRAM SMITH, for the past three years district sales manager of the Detroit district of the Edison Storage Battery Co., has been appointed assistant general sales manager, with headquarters at the main office, Orange, N. J. Mr. Smith is known throughout the trade as one of the "old-timers" in the storage battery business, having been active in the sale of lead batteries for many years before the advent of the alkaline storage batteries. Mr. Smith's earlier connections include such positions as western sales manager, secretary and treasurer of the National Battery Co., manager of the Chicago office of the United States Lighting & Heating Co., and assistant manager of the Edison Storage Battery Supply Co., San Francisco.

L. E. SCHUMACHER, who for the past eight years has been chief inspector of the Westinghouse Electric & Manufacturing Co. at East Pittsburgh, Pa., has been promoted to works manager of the Krantz Manufacturing Co., of Brooklyn, N. Y., the latest subsidiary of the former company. Prior to his coming to the Westinghouse Electric & Manufacturing Co. in June, 1900, he was employed at the Niagara Falls Power Co., which at that time was the largest electric water power installation in the world. His first duties at the Westinghouse company were the erecting of switchboards. Two years later he was transferred to the testing department where his previous experience was valuable in testing the various types of electrical apparatus. Later he was promoted to the position of general foreman of this department. In 1908 he was made assistant chief inspector, and in 1910 became chief inspector, which position he has held until now. He is especially prepared by his long experience in the manufacture of safety switches, panel boards and floor boxes for his new position with the Krantz Manufacturing Co., as it makes a specialty of these products.

THOMAS A. CARR, works manager of the American International Shipbuilding Corporation, Hog Island, Philadelphia, Pa., has resigned to become associated with the Boston (Mass.) office of Stone & Webster.

V. O. STAFFORD, manager of the Northern Iowa Gas & Electric Co., Clarion, Iowa, has resigned that position to become general contract agent for the company at Humboldt. Mr. Stafford is succeeded by J. V. Wilhelm.

J. K. MAHAFFEY, who has been representing the Edison Storage Battery Co. in Washington in connection with Government business, has been appointed district sales manager of the Pittsburgh district. Mr. Mahaffey has been in the employ of the Edison Storage Battery Co. since 1916. His previous connections include the General Electric Co., Jandus Electric Co., Adams-Bagnall Electric Co., Union Metal Manufacturing Co., and the Electric Products Co., of Cleveland.

COL. J. W. FULLER, president of the Fuller Engineering Co., Allentown, Pa., entertained at his pleasant home in Catasauqua last week a number of engineers, who afterwards visited Lykens, Pa., to see in operation a Babcock & Wilcox boiler, in which the fuel used with gratifying results was pulverized anthracite culm. The Susquehanna Collieries Co. owns the plant, which will be described in a later issue of this publication. Among the visitors were Fred A. Scheffler, of the Babcock & Wilcox Co., New York; Cloyd M. Chapman, of Westinghouse Church Kerr & Co., New York; George Dinkel, chief engineer of the American Sugar Refining Co.; Robert R. McLean, of Melbourne, Australia; W. A. Shoudy, of the J. G. White Engineering Co., New York; F. W. Casler and N. A. Carle, Public Service Electric Co., Newark, N. J., C. H. Bromley and Charles W. Price.

FREDERICK PEARSON, who for the past 15 years has been associated with Marshall Field & Co. as advisory engineer, in the development of its various manufacturing and merchandising enterprises in Chicago and elsewhere, has entered the practice of consulting engineer, with offices at Suite 941, Marshall Field Annex building, 25 East Washington street, Chicago. He will continue as advisory engineer to the above firm, in addition to other interests engaging his service. Mr. Pearson's experience has been most diversified, embracing electrical, mechanical, illuminating and chemical engineering. He enters into general consulting engineering practice well qualified from a technical, as well as practical standpoint. He is a member of most of the important engineering and technical societies in the United States in several of which he has held office; he was a member of the International Electrical Congress, St. Louis, 1904; also of the International Chemical Congress, Chicago and Washington, 1912. During the past several years he has contributed important papers and studies upon various engineering subjects, the result of his extensive experience and research.

J. W. REID has resigned as bridge engineer of the Chicago & Alton Railroad to enter the service of the Robins Conveying Belt Co., Chicago.

WILLIAM J. REAGAN, for a number of years connected with the sales department of the Utica Gas & Electric Co., Utica, N. Y., was recently appointed commercial manager of the company in charge of both lighting and power departments. Mr. Reagan will also direct the appliance sales.

H. A. LEMMON, sales manager of the Truckee River Electric Co., Reno, Nev., will leave shortly for Europe where he will be engaged for the next two years assisting Herbert Hoover in his problem of feeding the world, including the people of those countries who opposed the allied nations in the recent struggle. Mr. Lemmon rendered very effective service during the past several months as food administrator for Nevada and as manager of many of the national drives for funds that have taken place from month to month during the war period.

M. FRANKEL, manager of the Chicago office of the Roller-Smith Co., located at 740 Monadnock block, has been promoted to the position of assistant sales manager. Mr. Frankel's headquarters will remain in Chicago from which point he will supervise the activities of the Roller-Smith Co.'s Cleveland and Detroit offices as well as the Chicago office of which he is now and for several years has been in charge. In addition, Mr. Frankel will have direct charge of all the Roller-Smith Co.'s automobile instrument business including the states of Michigan, Ohio, Wisconsin, Illinois, Minnesota and parts of Pennsylvania and Iowa. His close familiarity with the company's products, as well as his acquaintance with the trade, gained through his connection with the company for the past six years or more, makes him particularly well qualified to handle the duties incident to his new position.

Obituary.

EDWARD ALLEN WICKS, president of the Niagara Falls Power Co., Niagara Falls, N. Y., died suddenly on Dec. 6, at his home, 420 Park avenue, New York. Mr. Wickes was also president and a director of the Tonawanda Power Co., North Tonawanda, N. Y., Cataract Power & Conduit Co., and a director of the Canada Southern Railway Co.

Now that the War Is Won—What?

XV.

Hold Fast!

TO EVERY ELECTRICAL MANUFACTURER:

From a practical standpoint War is now over but co-operation between Manufacturers and Government, with the full potentiality of the emergency through which we have just passed, is emerging into an era of tremendous possibilities.

At the Atlantic City Conference of War Service Committees it was emphasized by many speakers that the best policy of this country in the matter of raw materials would be to treat even the Central Powers generously so that they may be enabled to pay the debts imposed by the war.

It was clearly indicated that the supply of raw materials is insufficient to fill reconstruction needs essential to the economic development of the countries engaged in the war.

It was pointed out that the ocean tonnage available at present must be carefully allocated to provide an equitable distribution of such raw materials.

It was urged that the exercise of the same spirit of patriotism, which actuated every individual during the period of the war, is required now to meet the problems of reconstruction; a failure in this must inevitably result in great confusion and serious loss to Industry.

To provide the opportunity for Industry to mobilize and co-operate in the solution of reconstruction problems in the same manner it did for "Winning the War," the Secretary of Commerce has invited fourteen of the leading men in the War Industries Board to serve as his advisers for the period of reconstruction.

Industry is thus given an opportunity to continue, through its War Service Committees, the co-operative effort which has proven so effective in war, by establishing a direct contact through the Department of Commence between the Government and Industry whereby the needs of each may speedily receive due consideration and appropriate action.

Accordingly your General War Service Committee has in your behalf accepted the invitation and proffered to the Government the services of our War Service Organization.

In order that we can discuss the means which will best fulfill our obligation to render full assistance to the Government in this difficult situation, a general meeting will be called at the earliest possible date.

MEANWHILE HOLD FAST—SUFFER NO CHANGE OF POLICY WITHOUT CONSULTING WITH YOUR GROUP COMMITTEE.

A copy of Nation's Business reporting in full the proceedings at the Atlantic City Conference will be mailed to you. Your attention is specially directed to the address of President Harry A. Wheeler, of the Chamber of Commerce of the United States.

Signed A. W. BERRESFORD
CLARENCE L. COLLENS, 2ND
JAMES C. HOBART
J. R. McKEE
WILLIAM WALLACE NICHOLS
CHARLES A. TERRY
Committee.

GENERAL WAR SERVICE COMMITTEE
OF THE
ELECTRICAL MANUFACTURING INDUSTRY
50 Church St., New York City.

Financial News

Cost of Service Plan of Public Utilities.

In a paper prepared for the annual meeting of the Empire State Gas and Electric Association, Harlow C. Park says:

"In the effort to secure a stable and satisfactory basis for the relations between public utilities and the communities which they serve, more and more attention is being given to what has become known as the 'cost of service' plan. While up to the present time practical application of this method of determining rate has been largely confined to electric railways, nevertheless in some instances it has been applied to lighting companies and in more instances it is being considered in connection with the regulation of their rates.

"The 'cost of service' plan is predicted upon the theory that utility service should be furnished to the public at its exact cost and without unusual or speculative profits to anyone. Included in this cost of service is the cost of the capital necessary for the furnishing of the service. Theoretically, this cost is the least return at which capital may be secured. Practically, the rate to be paid thereon has been specifically fixed in most instances by the term of the various franchises.

"Whether it is the answer to the problems that confront the utility world at the present time is not an easy question to determine. In but one city has it been for any length of time in operation and there objections have developed. It is certainly true, however, that it is being regarded with increasing favor by certain sections of the public and by not a few operators of public utilities. It is not at all improbable that conditions brought about by the war will force Federal control of electric railways, and perhaps of other utilities. It is, however, inconceivable that such control will continue after the war is ended. The time seems ripe, therefore, for the closest study by utility men of means and methods of readjusting their relations with the public in order that the present state of uncertainty, distrust and chaos may give way to a better understanding and a more satisfactory basis for carrying on an industry so essential to the public welfare. The Cost of Service Plan may furnish a basis for this."

Public and Officials Grant Many Rate Increases to Utilities.

Commenting on the public utility situation, Arthur S. Huey, vice-president of H. M. Byllesby & Co., says:

"Every one realizes that the operating costs of electric and gas companies have increased tremendously and we appreciate the attitude of the public who, through their officials, have permitted rate increases in almost all of the cities and towns served by companies under the management of H. M. Byllesby & Co. We believe that this fair attitude on the part of the public is due to the policy of our companies in the past, in steadily reducing rates whenever the cost of production would permit.

"As a result of rate increases now in effect the earnings of our companies are being maintained and we are able to give 100% service.

"How long it will be necessary to charge the higher rates depends, of course, upon operating costs. It is our intention, however, to reduce them to a pre-war basis as rapidly as conditions permit."

Dallas Power Makes Report.

The annual report of Grover C. Bland, chief accountant in the office of the supervisor of public utilities of Dallas, shows that the net earnings of the Dallas Power & Light Co. on a year's operation up to Sept. 30 totaled $665,551.90. This is equivalent to a return rate on the property value of 12.85%. As the company is permitted a return of but 8%, the balance, amounting to $251,268.98, accumulated to the credit of the surplus reserve, maintenance and depreciation reserve and the accident reserve.

Illinois Companies File Joint Petition for Sale of Property.

Joint petitions have been filed with the Illinois Public Utilities Commission for approval of the sale to the Citizens Utilities Co. by the Davis Electric Co. of the electric plant in Davis, Ill., for $5900, of the business of Walter Bliss, doing business as the Durand Electric Light Co. at Durand, and of the plant of W. C. Smith, operating as the Smith Light & Power Co., at Dakota. The Citizens Utilities Co. also filed a petition asking for a certificate of convenience and necessity to operate the electric light and power plants at Durand, Davis, Rock City and Dakota and to issue common capital stock to the amount of $40,000.

Dividends.

American Public Service Co. has declared a quarterly dividend of 1¾% on preferred stock, payable Jan. 2 to stock of record Dec. 14.

Springfield Railway & Light Co. has declared a quarterly dividend of 1¾% on preferred stock, payable Jan. 2 to stock of record Dec. 14.

Buffalo General Electric Co. has declared a quarterly dividend of 2%, payable Dec. 31 to stock of record Dec. 20.

Canadian General Electric Co. has declared a quarterly dividend of 2%, payable Jan. 1 to stock of record Dec. 14.

PACIFIC GAS & ELECTRIC.

	October, 1918.	October, 1917.	10 mos. ending Oct. 31, 1918.	10 mos. ending Oct. 31, 1917.	12 mos. ending Oct. 31, 1918.	12 mos. ending Oct. 31, 1917.
Gross operating revenue.	$1,910,696	$1,619,738	$18,412,851	$16,296,963	$21,929,268	$19,579,199
Expenses, including taxes, reserves for depreciation, etc.	1,339,362	1,183,509	12,398,849	10,477,208	14,776,331	12,264,787
Net earnings from operation	$ 571,334	$ 436,229	$ 6,014,602	$ 5,819,755	$ 7,152,937	$ 7,314,412
Add profits on merchandise sales and other miscellaneous income.	40,087	53,175	407,203	446,921	468,630	602,694
Total net income	$ 611,421	$ 489,404	$ 6,421,205	$ 6,266,676	$ 7,621,567	$ 7,917,106
Deductions:						
Bonds and other interest.	$ 341,155	$ 345,470	$ 3,433,294	$ 3,412,769	$ 4,121,431	$ 4,025,401
Apportionment bond discount and expense	15,426	15,426	154,264	154,197	185,116	183,065
Accrued dividends on preferred stocks	124,461	123,935	1,242,770	1,236,504	1,490,750	1,457,726
Total deductions	$ 481,042	$ 484,831	$ 4,830,328	$ 4,803,470	$ 5,797,297	$ 5,666,192
Balance	$ 130,378	$ 4,571	$ 1,590,877	$ 1,463,204	$ 1,824,268	$ 2,250,912

WEEKLY COMPARISONS OF CLOSING-BID PRICES OF SECURITIES OF LEADING ELECTRICAL COMPANIES.

Quotations furnished by F. M. Zeller & Co., Rookery Bldg., Chicago.

Public Utilities—	Div. rate. Per cent.	Bid Dec. 3.	Bid Dec. 10.
Adirondack Electric Power of Glens Falls, common	6	14	14
Adirondack Electric Power of Glens Falls, preferred	6	69	69
American Gas & Electric of New York, common	10+extra	103	103
American Gas & Electric of New York, preferred	6	43	43
American Light & Traction of New York, common	..	229	228
American Light & Traction of New York, preferred	6	100	100
American Power & Light of New York, common	4	55	55
American Power & Light of New York, preferred	6	74	74
American Public Utilities of Grand Rapids, common	..	..	..
American Public Utilities of Grand Rapids, preferred	7	38	36
American Telephone & Telegraph of New York	..	103¾	103½
American Water Works & Elec. of New York, common	..	7	7
American Water Works & Elec. of New York, particip	7	14	14
American Water Works & Elec. of New York, first preferred	..	65	65
Appalachian Power, common	..	2	2
Appalachian Power, preferred	7	10	10
Cities Service of New York, common	+extra	292	293
Cities Service of New York, preferred	6	81	81½
Commonwealth Edison of Chicago	8	116	118
Comm. Power, Railway & Light of Jackson, common	..	23	22
Comm. Power, Railway & Light of Jackson, preferred	6	48	46
Federal Light & Traction of New York, common	..	9	9
Federal Light & Traction of New York, preferred	..	39	39
Illinois Northern Utilities of Dixon	6	..	..
Middle West Utilities of Chicago, common	2+extra	27	27
Middle West Utilities of Chicago, preferred	6	56	56
Northern States Power of Chicago, common	..	60	60
Northern States Power of Chicago, preferred	ex.div.7	86	86
Pacific Gas & Electric of San Francisco, common	..	40	40
Pacific Gas & Electric of San Francisco, preferred	6	85	86
Public Service of Northern Illinois, Chicago, common	7	92½	89
Public Service of Northern Illinois, Chicago, preferred	6	88	88
Republic Railway & Light of Youngstown, common	4	18½	18½
Republic Railway & Light of Youngstown, preferred	6	57	57
Standard Gas & Electric of Chicago, common	..	11½	13
Standard Gas & Electric of Chicago, preferred	6	32	32
Tennessee Railway, Light & Power of Chattanooga, common	..	3¼	3¼
Tennessee Railway, Light & Power of Chattanooga, preferred	6	16	16
United Light & Railways of Grand Rapids, common	4	38	39
United Light & Railways of Grand Rapids, preferred	6	72	71
Western Power of San Francisco, common	..	14	14
Western Power of San Francisco, preferred	6	60½	60
Western Union Telegraph of New York	extra	88	88
Industrials—			
Electric Storage of Philadelphia, common	4	51	51
General Electric of Schenectady	8	154	152
Westinghouse Electric & Mfg. of Pittsburgh, common	7	43¼	43½
Westinghouse Electric & Mfg. of Pittsburgh, preferred	7	60	60